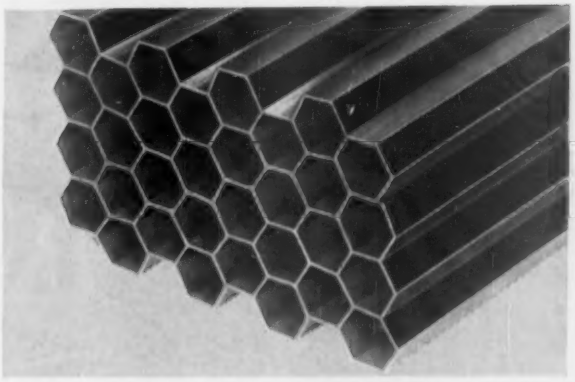
*News about*

# B.F.Goodrich Chemical *raw materials*

## *blister resistant Hycar

## *new compounds meet industrial specs



*One of the new applications of Hycar American Rubber is this honeycomb which is multiple extruded and used as a spring core for freight car journal box lubricators. A unique rubber product, it has exceptional radial spring, axial stiffness and stability of shape and dimension. It withstands temperature extremes, oil immersion and abrasion.*

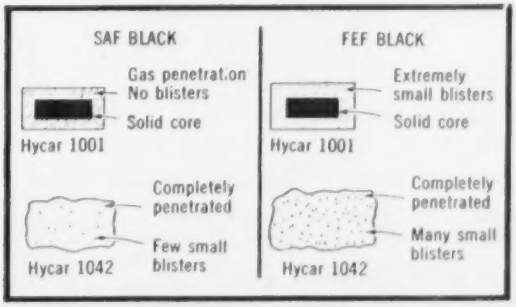
**Blister resistant Hycar for high pressure gas service.** A new, extremely strong and blister resistant Hycar compound — 1001/SAF — has been developed specifically for making sleeves and diaphragms used in high pressure regulators for the oil and gas industry. Ordinary rubbers proved unsatisfactory because they did not have high oil resistance combined with physical strength to reduce oil and gas penetration; and the ability to withstand internal pressures from entrapped gases after flow pressures up to 3000 psi were removed. This pressure removal often caused severe swelling or complete rupture of parts made from ordinary rubber. Following tests on various Hycar compounds, these conclusions were reached:

**(1) High acrylonitrile Hycar polymers perform best.**

**(2) Loading with fine particle size blacks give highest blister resistance. SAF black provides the best results.**

**(3) Plasticizers increase blistering. Extractable types are especially bad. Small amounts of non-extractable plasticizer can be used as a processing aid.**

**(4) The curing system is not important as long as a tight cure is obtained.**




*Cross sections of several polymers were made after one week's exposure to 100 psi carbon dioxide and 600 psi ethylene. These sections clearly show the superior blister resistance of high acrylonitrile Hycar 1001 and the better performance achieved through SAF Black Loading. Base recipe for this test: Hycar polymers 100.0; Zinc oxide 5.0; Black loading 40.0; TMTD 3.5; Stearic Acid 1.0.*

### *NEW HYCAR COMPOUNDS FOR INDUSTRIAL SPECIFICATIONS*

**Bendix-Westinghouse Spec 1036-M** . . . requiring very low volume change after immersion in ASTM No. 1 and No. 3 oils and satisfactory performance at −40°F. Primary uses: valves and valve seats. *Hycar 1042 compound.*

**Military Spec MIL-G-1086A** . . . requiring resistance to aviation gasoline, water and asphalt. For gaskets on bolted steel storage tanks. *Hycar 1042 compounds.*

**Allison Proposed Spec 22619** . . . requiring a 90±5 Durometer A compound with excellent oil resistance at high temperatures. Two Hycar 1042 compounds meet the spec.

**Automotive Spec No. 69** . . . requiring a 70±5 Durometer A compound, good oil resistance and ability to withstand temperature extremes. Applications: lip-type seals and other automotive seals. A Hycar 1042 compound has narrow volume change limits after aging in ASTM No. 1 oil at 300°F; and −15°F low temperature brittleness.

For further information on Hycar nitrile rubber, write Dept. HO-6, B. F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ont.

**Hycar**
*American Rubber*

**B.F.Goodrich Chemical Company**
**a division of The B.F.Goodrich Company**

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**PHILLIPS CHEMICAL COMPANY,** Rubber Chemicals Division, 318 Water St., Akron 8, Ohio. **District Offices:** Chicago, Providence and Trenton. **West Coast:** Harwick Standard Chemical Company, Los Angeles, California. Warehouse stocks at above points and Toronto, Canada. **Export Sales:** 80 Broadway, New York 5, N. Y.

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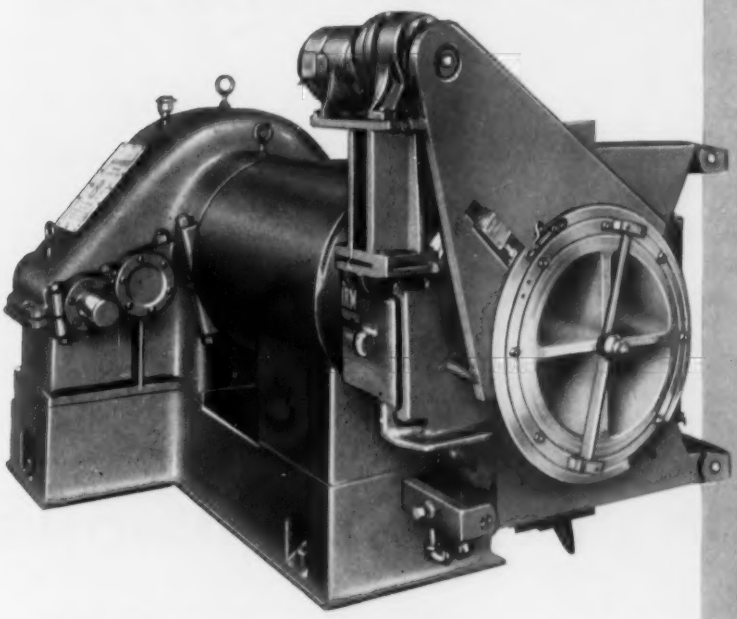
# These *Exclusive* features make NRM RUBBER STRAINERS the most time-saving, cost-cutting strainer in the industry

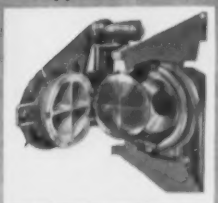


Advanced design and engineering features like these are only a few of the many reasons which have made NRM Rubber Strainers the "standard" of the industry. Plant owners appreciate, too, their space-saving compactness, installation ease and operating simplicity.

Our new data bulletin on NRM Rubber Strainers fully explains design, construction and operating features and advantages. A postcard brings it to you without delay. See for yourself why rubber goods manufacturers the world over rely on NRM Strainers for trouble-free *sustained* high production, at minimum maintenance cost.

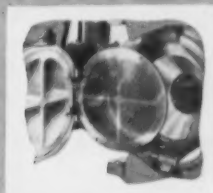
**QUICK-OPENING HEADS**

**Merely flip a valve and air-operated clamps are *instantly* released and the NRM head can be swung open. This compares with 5 to 10 minutes or longer required to open other types of heads. Screen-changing time is reduced to an absolute minimum.**



**HINGED STRAINER PLATES**

**NRM Strainer Plates are hinged directly on the head assembly to provide quick access to head interiors. Cleaning of both plate and the head cavities is thus made easier and faster.**



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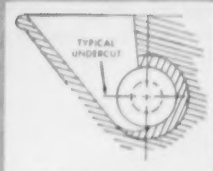
**Offset and undercut, NRM Feed Boxes provide uniform, maximum stuffing of the cylinder. Whether hand or strip fed, the undercut enables the screw to "pull" steadily, preventing voids in the cylinder and providing maximum thru-put.**




*write for*

**MORE DETAILS ON NRM RUBBER STRAINERS TODAY**

2879

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**WEST:** S. M. Kipp, Box 441, Pasadena 18, Cal.
**MID-WEST:** National Rubber Machinery Co., 5875 N. Lincoln Ave., Chicago 5, Ill.
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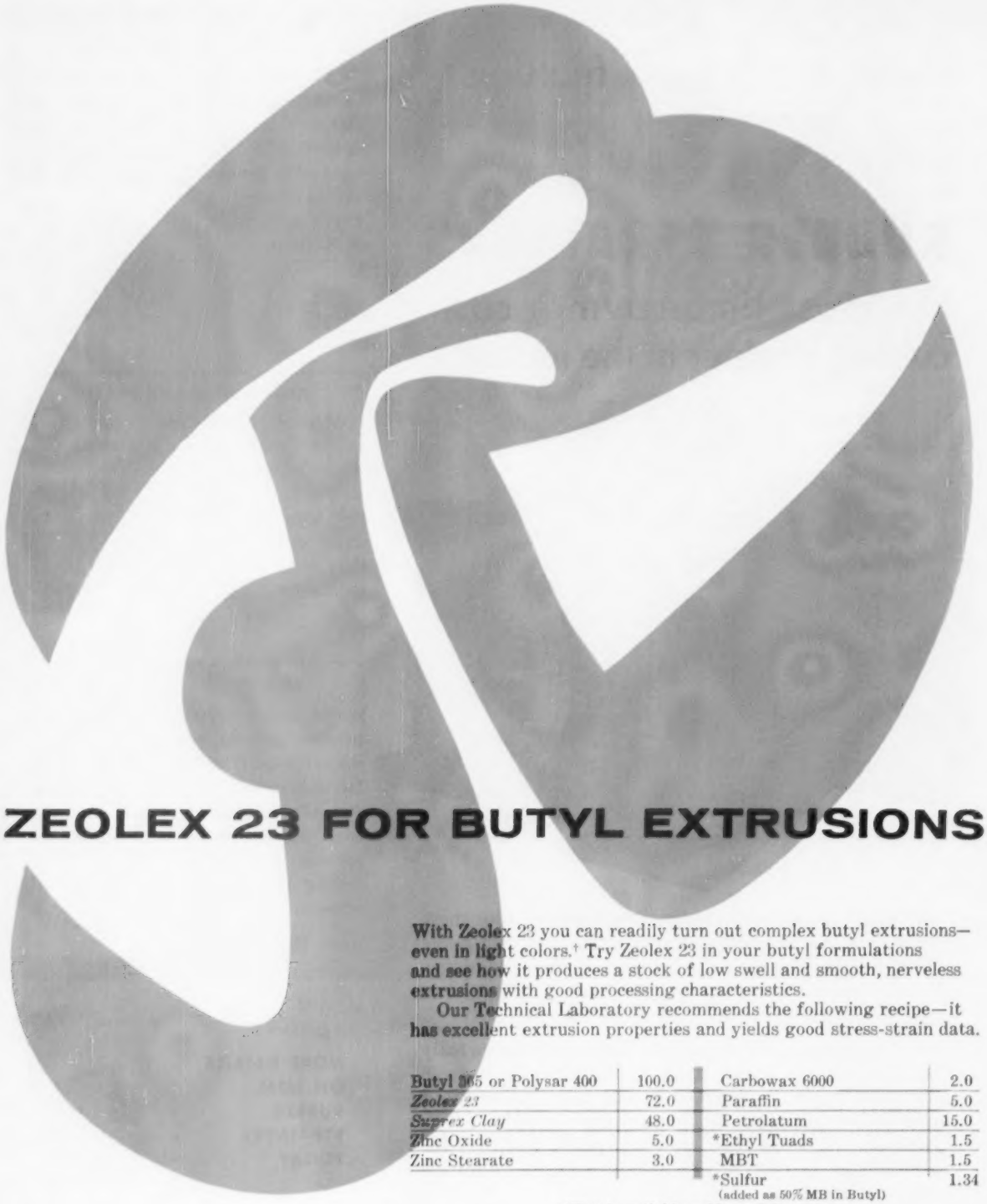

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|---|---|---|---|
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| *Suprex Clay* | 48.0 | Petrolatum | 15.0 |
| Zinc Oxide | 5.0 | *Ethyl Tuads | 1.5 |
| Zinc Stearate | 3.0 | MBT | 1.5 |
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*Total available sulfur = 1.5 parts

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# Rubber Age

COVERING THE MANUFACTURE OF RUBBER AND RUBBERLIKE PLASTICS PRODUCTS

JUNE, 1957 VOL. 81 NO. 3

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## In This Issue


447 **Compounding Rubber for Resistance to Silicate-Ester Type Hydraulic Fluids at 400°F. II—Nitrile, Vinyl Pyridine, Butyl and Acrylate Polymers**—By W. J. Mueller and R. A. Clark

The second part of a two-part article outlining efforts made to develop a rubber composition to resist degradation when used in contact with silicate-ester fluids.

460 **Investigation of the Pandux Tester for Use in Determining the Comparative Compression Resistance Values of Latex Foam Rubber Materials**—By S. A. Eller

Covering an investigation to determine the suitability of the Pandux tester for obtaining compression resistance values of latex foam.

465 **Procedure in Obtaining Patents. II—How to Prepare the Patent Application**—By Kenneth W. Brown, Arthur S. Collins and Curt B. Beck

Factors involved in preparing the patent application are covered in this second part of a four-part article.

471 **Carbon Black and Silica Reinforcing Agents for Rubber**

A report of a symposium held by the Southern Rubber Group, including a complete transcript of the talks given by each of the panel members.


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*Appears every other month


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Microfilm copies of complete volumes of RUBBER AGE are available from University Microfilms, 313 North First St., Ann Arbor, Mich.
Indexed in Industrial Arts Index and Engineering Index


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*mixing the Day way at Goodyear.....*

**DAY BLENDERS . . .** selected by the Goodyear Tire & Rubber Co. because these blenders are best suited for their new dry-mixing method for Vinyl compounds. Hundreds of other manufacturers all over the country are profiting from the long, dependable service of these blenders.

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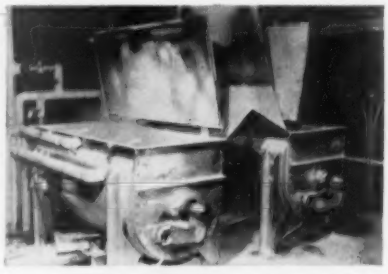

Photo shows two of many Day Blenders being used at the Goodyear Tire & Rubber Co. for mixing a variety of compounds.

Day Blenders are available in capacities from one cubic foot to 2300 cubic feet. Plain, galvanized or stainless steel tanks. Jacketing is optional. Write for Bulletin 800.

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# Letters to the editor

## Personnel Problems

*It has been apparent for some time that the scientific manpower shortage has reached serious proportions. The problem is even more severe where government agencies are concerned because of the disparity between government pay scales and prevailing industry rates. Many government officials report that it is almost impossible to hire chemical engineers, for example, at salaries the government can offer. The two letters which follow are typical of many received in these offices.*

EDITOR

Dear Sir:

The Patent Office is desperately in need of engineers and scientists to serve as Patent Examiners. While delays in the processing of patent applications in the Patent Office have been somewhat reduced during the past year, it still takes about ten months before a new patent application is first examined, and an average of 3½ years before a patent is issued. These delays create uncertainty as to the patent status of new products and processes and tend to slow down or defer their adoption by industry and their introduction to the public.

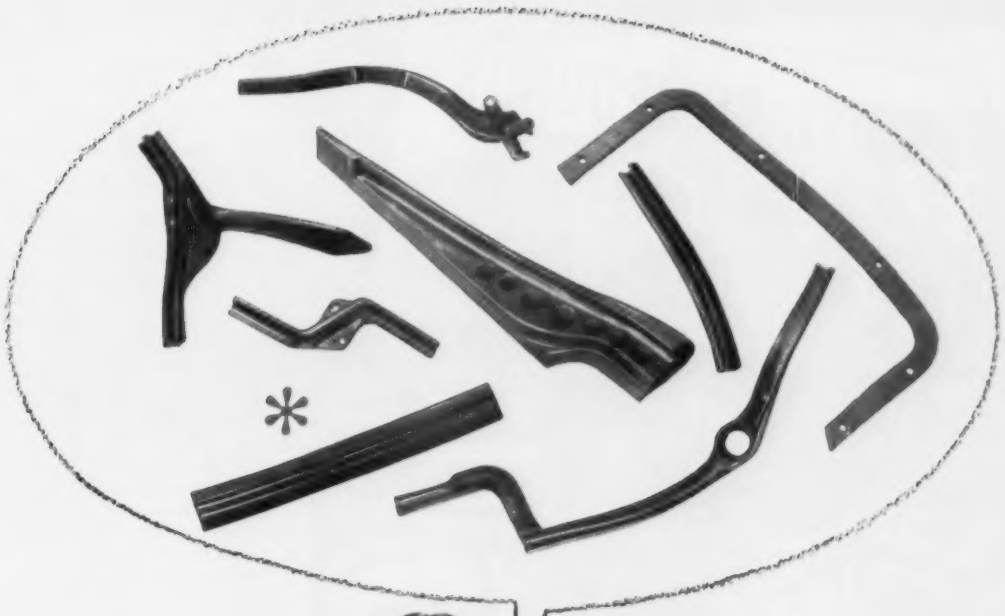
Men and women holding college degrees in engineering or applied science, or a degree with a major in chemistry or physics, or with certain combined credits in these fields, are eligible for appointment as Patent Examiners, without examination, upon application to the Commissioner of Patents in Washington, D. C.

Under the revised salary schedule the minimum starting salary is $4,480 per year. Promotion to $5,335 per year may be expected after three months' service, based solely on ability and work performance. With as little as six months of professional experience in engineering, chemistry, physics, or patent law, the starting salary is $5,335 per year with an expected increase to $6,250 nine months later. It is normal for an examiner to be earning $8,215 annually in less than five years after graduation from college, with additional opportunities for promotion up to $13,760. Additional details may be obtained from the New York Patent Law Association.

HENRY E. SHARPE
New York Patent Law Assn.
New York, N. Y.

Dear Sir:

The Naval Air Material Center, Philadelphia 12, Penna., has an urgent need for qualified Electronic Scientists, Metallurgists, Physicists, Technologists, and Engineers (Aeronautical, Electrical, Electronic, Industrial, General, Mechanical and Power Plant). The Center is currently engaged in an extensive program



* *Everyone's talking about the new "cold," low Mooney polymer*

**ASRC 3110!**

*Gives improved processing... better quality!*

Rubber parts courtesy of Brown Rubber Co., Inc.

ASRC is now in production with a new, non-staining "cold," low Mooney rubber—ASRC 3110—which offers improved processing of molded and extruded sponge rubber parts. Users can expect easier mixing . . . smoother extrusion . . . faster extrusion rates . . . smoother calendering . . . less shrinkage.

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Literature and test samples available upon request.

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of aeronautical research, development, experimentation and test operations for the advancement of Naval aviation. Starting salaries range from $4,480 to $7,570 per annum. Application for Federal Employment, Standard Form 57, should be filed with the Industrial Relations Department, Naval Air Material Center, Naval Base, Philadelphia 12, Penna. Applications may be obtained from the above address or information as to where they are available may be obtained from any first or second class post office.

OSCAR E. LOESER
Commander, U.S.N.
Naval Air Material Center
Philadelphia, Penna.

## False Economy

As I was reading your editorial in the May issue on the false economy involved in doing away with the activities of the Rubber Branch of the Business and Defense Services Administration, I thought of all the similar editorials in other publications pleading the same case. Your editorial noted that the Rubber Branch operates at a cost to the government of some $75,000 a year. Your editorial also noted that there are twenty-five industry divisions within BDSA. I would imagine that the other twenty-four divisions have at least as good a case for survival as does the Rubber Branch. What we are speaking of, then, is not $75,000, but close to $2,000,000. Now this may seem like a drop in the bucket to some, but it is a considerable sum, nevertheless.

The old bromide seems to hold true: Everybody is for economy — for everybody else. I am sure that if Rubber Branch activities were curtailed, the government would find some other way to handle allocation controls in the event of an emergency. So what we are talking about comes down to the statistical services offered by this agency. Now I don't think that the rubber industry will cease operations if government statistics are no longer available. I do think that the rubber industry will suffer great harm, however, if these budget excesses are permitted to get out of hand and a runaway inflation sets in. Maybe we ought to rethink our attitudes a little.

NAME WITHHELD

*Our May editorial pointed out that the collection and issuance of statistical information is a function which the government is best suited to perform. Government statistics on rubber make possible not only business planning, but are invaluable to the government itself in determining such matters as stockpiling and civilian and domestic requirements for rubber.*

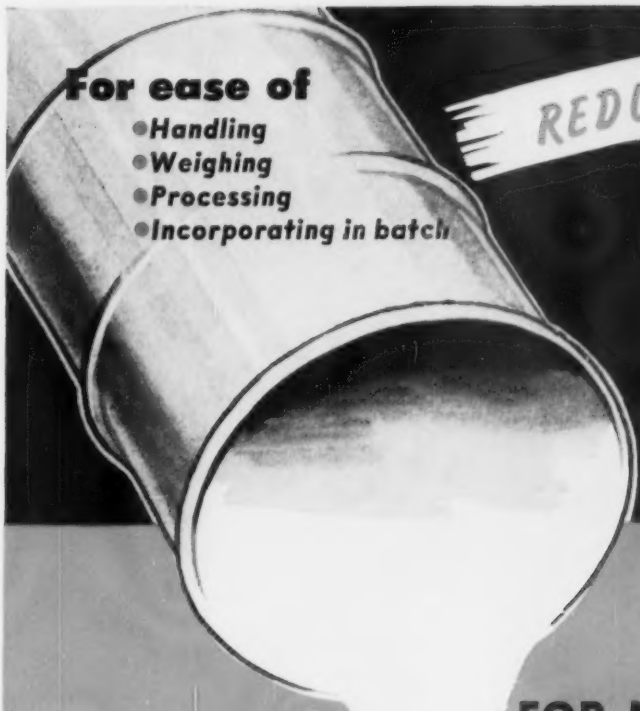
EDITOR

## Capitol Cues

Dear Sir:

May I commend you on the addition of the section entitled "Capitol Cues." These Washington reports make a valuable addition to your publication.

F. SNYDER
Miami, Fla.



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- Incorporating in batch

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*A pressure sensitive Plasticizing Resin*

## FOR NATURAL, GR-S, AND BUNA-N TYPE RUBBERS

## POLYMEL DX-111 POWDER RESIN

***blends without applying heat!***

RECOMMENDED FOR USE IN THE FOLLOWING PRODUCTS

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Compounding ingredients for Reinforcing, Plasticizing, Extending and Processing Natural and Synthetic Elastomers.

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*Properties*

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|---|---|---|---|
| Natural State | Powder | Specific Gravity | 1.11 |
| Color | Amber | Melting Point | Pressure Sensitive |
| Composition | Modified Polystyrene | | |
| Odor | Characteristic | | |
| Toxicity | Not known to be toxic | | |

*Prices* (F.O.B. Baltimore)

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| Truckloads | .13¼¢ lb. |

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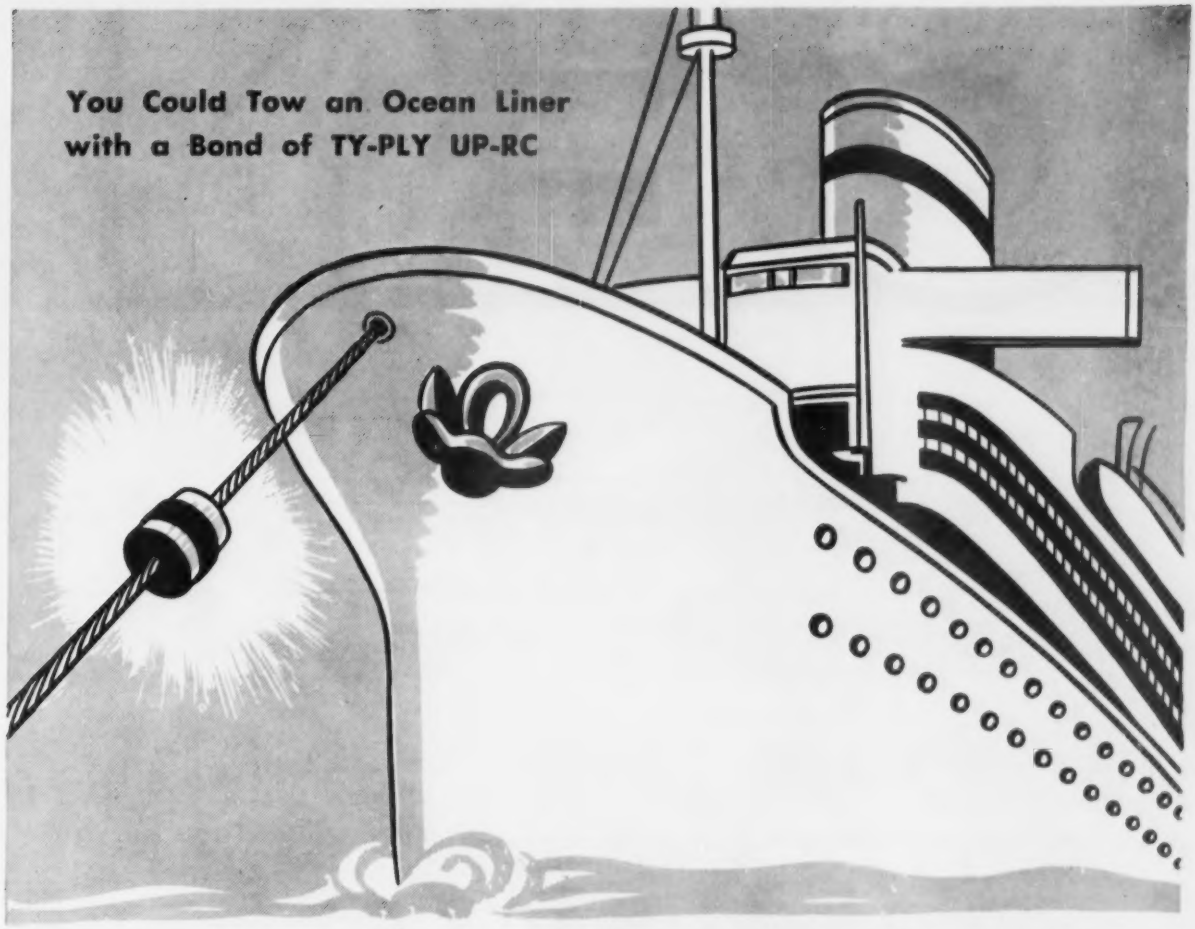


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**TY-PLY "UP-BC"**

Two-coat Adhesive System for Bonding of Butyl Rubbers.

**TY-PLY "Q" or "3640"**

the single coat adhesive for bonding Natural and GR-S compounds.

**TY-PLY "BN"**

for bonding N-types

**TY-PLY "S"**

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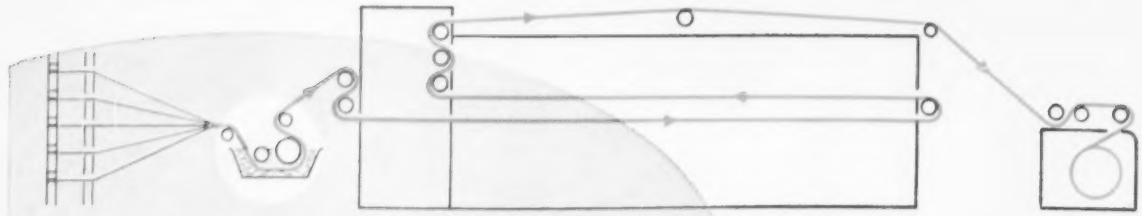
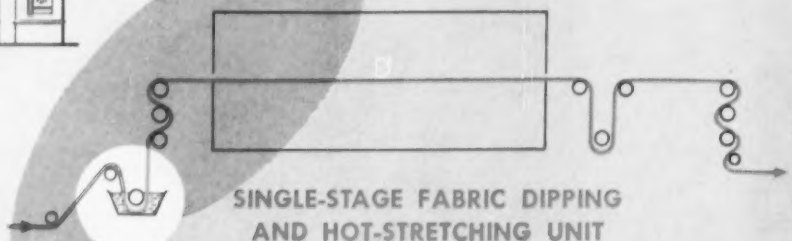
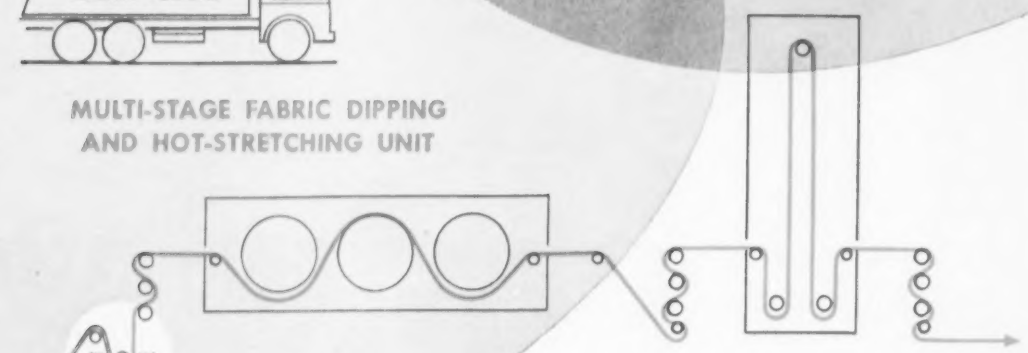


SINGLE CORD DIPPING AND
HOT-STRETCHING UNIT



SINGLE-STAGE FABRIC DIPPING
AND HOT-STRETCHING UNIT

MULTI-STAGE FABRIC DIPPING
AND HOT-STRETCHING UNIT



# . . . the adhesive for any of these cord-treatment methods

Whichever method you use—or plan to use—in treating nylon cord, Gen-Tac assures the best possible rubber-to-fabric adhesion. This outstanding vinyl pyridine latex has proven its stability, uniformity and performance in world-wide usage over the past seven years.

If you are operating or installing equipment to meet the rapidly-increasing demand for nylon tires, we will be glad to work with you on any adhesion problems which may arise.

**THE GENERAL TIRE & RUBBER COMPANY**

**CHEMICAL DIVISION • AKRON, OHIO**

*Creating Progress Through Chemistry*

Chemical Division GENERAL THE GENERAL TIRE & RUBBER CO. GEN-TAC®

## In coated fabrics— Kalite® gives you excellent calendering

Here's a semi-reinforcing filler—DIAMOND KALITE—that will improve surface smoothness and reduce shrinkage in calendered compounds.

DIAMOND recommends KALITE for light, pastel or dark-colored, highly loaded, soft rubber compounds requiring low stiffness and high elongation. At proper loading, it increases tear resistance and tensile strength. KALITE also makes it easier to process calendered scrap by eliminating tackiness and stickiness.

In extruded compounds—insulated wire, inner tubes—KALITE permits higher tubing speeds by improving the flow of compounds. KALITE mills with extremely low heat generation.

Call your DIAMOND representative today for information and technical help on KALITE and other top-grade calcium carbonates. Or write DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

**Diamond Chemicals**

# KEEP YOUR BANBURY® MIXER RUNNING SMOOTHLY

## with regular visits from a factory-trained specialist

Any one of these five Farrel-Birmingham service engineers is a good man to get acquainted with. He knows your Banbury mixer and its characteristics... what it can do... what makes it tick... or keeps it ticking... what (if anything) is wrong and how it can be cured quickly, correctly.

His knowledge is based on years of factory training and a storehouse of "know-how" developed through contacts with industry. Further, he's backed by the original manufacturer of the Banbury mixer—Farrel-Birmingham. As a result, he is able to recommend research-improved parts and materials—give you rebuilding that assures new Banbury performance.

The Farrel-Birmingham specialist is a regular and welcome visitor in hundreds of plants. They rely on him for expert advice on rebuilding problems, mixing practice, and related equipment built by the company. And, they often arrange, through him, for "Planned Banbury Downtime"—thus eliminating the possibility of trouble at a critical production period.

Call and arrange for no-charge visits from an F-B specialist.

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ANN ARBOR, MICH., 3061 Dexter Road (NOrmandy 2-5978)
CHICAGO 43, ILL., 10725 South Western Ave. (PRescott 9-3421)
LOS ANGELES 21, CALIF., 2032 Santa Fe Ave. (LUdlow 5-3017)
HOUSTON 2, TEXAS, 860A M&M Building (CApitol 2-6242)
FAYETTEVILLE, N. C., P. O. Box 3157 (HUdson 4-5261)

*Farrel-Birmingham*®

**WALTER D. TAYLOR**—1929: joined company. Served 5 years as machinist apprentice; 5 years as machinist; one year on gear drives. 1941: transferred to sales and service. 1945: made senior sales engineer. Presently manager of field service.

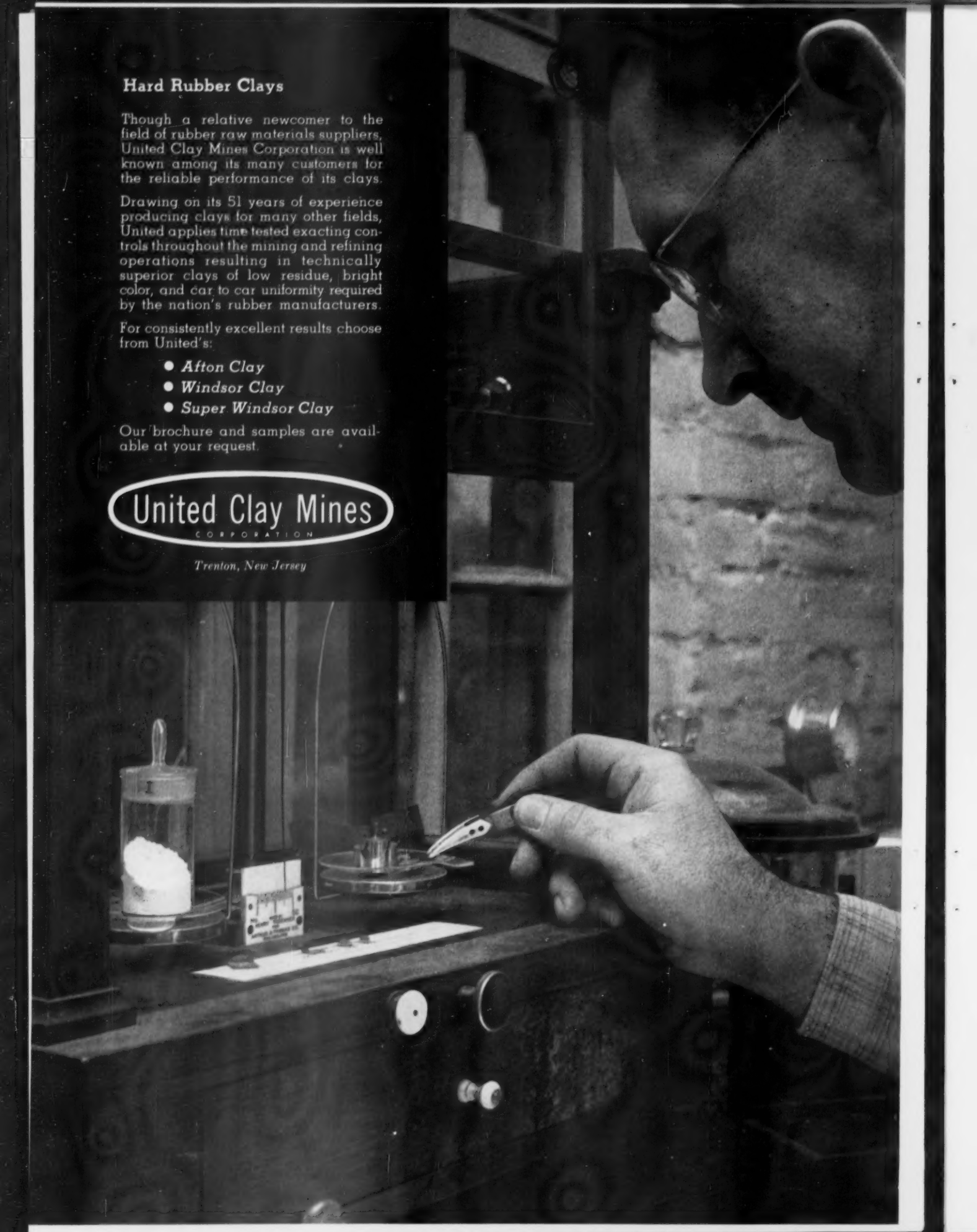
**RICHARD E. BAKER, JR.**—1937: came to Farrel-Birmingham from Ford Motor Company as skilled machine assembler. Erector for ten years, last two as group leader. 1946: transferred to Banbury division as sales-service engineer.

**GEORGE WILSON**—1940: joined Farrel-Birmingham as learner. Made machine assembler following year. 1943-55: machinery installation in customers' plants. 1955: transferred to Banbury division as sales-service engineer.

**ALFRED W. MARSCH**—1940-44: Farrel-Birmingham apprentice. 1944-46: U. S. Army—returned to company as machine erector. 1954: transferred to Akron as sales-service engineer.

**EDWARD H. SHORTELL**—1941: started as learner-erector. Became machine assembler same year. 1945: made erector of machinery—has handled large installations in customers' plants. 1955: transferred to Chicago as sales-service engineer.

FB-1121



## Hard Rubber Clays

Though a relative newcomer to the field of rubber raw materials suppliers, United Clay Mines Corporation is well known among its many customers for the reliable performance of its clays.

Drawing on its 51 years of experience producing clays for many other fields, United applies time tested exacting controls throughout the mining and refining operations resulting in technically superior clays of low residue, bright color, and car to car uniformity required by the nation's rubber manufacturers.

For consistently excellent results choose from United's:

- *Afton Clay*
- *Windsor Clay*
- *Super Windsor Clay*

Our brochure and samples are available at your request.

**United Clay Mines**
CORPORATION

*Trenton, New Jersey*

Photo courtesy Hofran Incorporated, Tampa, Fla.

# Now—"Iron Mike" has met his master!

**It's tough to make** the starting team in the big leagues. But for a baseball, it's even tougher to qualify for batting practice. For here there's little letup in the pounding, the scuffing or the skinning. Particularly when "Iron Mike," the pitching machine, does the serving up.

**A standout performer** in this job – and in playgrounds, sand lots and batting ranges across the country–is an unusually durable ball with a molded-on, rubberized cord cover. This cover fully resists impact, abrasion and moisture, including repeated washing. As a result the ball retains its size, shape, weight and "grippability" much longer than its higher priced counterparts.

**Much of the success** of this ball lies in the use of three Goodyear materials in the cover compound. PLIOFLEX, the light-colored, oil-extended rubber, lowers both weight and cost without loss of desirable qualities. PLIOLITE S-6B – the high styrene, rubber reinforcing resin – adds toughness and a leatherlike feel. And WING-STAY S–a nonstaining antioxidant–protects the original whiteness and physical properties against age and sunlight.

**Mastering "Iron Mike"** is just one example of how properly compounded PLIOFLEX rubber can answer many product problems. If you would like more information on how PLIOFLEX or PLIOLITE S-6B or WING-STAY S can help your products, just write to:
Goodyear, Chemical Division, Dept. F-9419, Akron 16, Ohio.

CHEMICAL
GOODYEAR
DIVISION

RUBBER & RUBBER CHEMICALS DEPARTMENT

Chemigum, Plioflex, Pliolite, Plio-Tuf, Pliovic, Wing-Stay – T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

CHEMIGUM • PLIOFLEX • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS
High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries

# It's won fame in foam

Its name is WING-STAY S. It's a liquid styrenated phenol. And it's the leading choice of foamed goods manufacturers for a non-discoloring, nonstaining antioxidant.

WING-STAY S won its fame in foam for these good reasons: 1. It is easily emulsified and incorporated in latex 2. It is not extracted by water 3. It is nonvolatile, even when large surface areas are involved 4. It is nondiscoloring 5. It provides good all-round protection 6. It is low in cost.

If you want protection from heat, sunlight or age that will bring fame to your products—foamed or solid—get the full story on WING-STAY S. Samples plus the latest *Tech Book Bulletins* are yours by writing to: Goodyear, Chemical Division, Akron 16, Ohio.

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DIVISION

RUBBER &
RUBBER CHEMICALS
DEPARTMENT

Chemigum, Plioflex, Pliolite, Plio-Tuf, Pliovic, Wing-Stay—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

CHEMIGUM • PLIOFLEX • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS

High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries

# A rubber to count on when the chips are down

Nothing eats the heart out of ordinary rubber like exposure to oils, greases and solvents. At this paper mill, for example, exuded pine oil on the chips cut conveyor belt life to 6 months at most. Then a belt with its cover made of CHEMIGUM came to the rescue. At last report, it had served 5 times as long—and still no end in sight.

You see, CHEMIGUM is a nitrile rubber. It's especially resistant to all types of grease and oils – even at high temperatures. It's easily processed into a variety of rubber products—from conveyor belts to hose to printing press rolls to tiny oil seals. In fact, there's nothing quite like it for long, satisfactory service in operations involving petroleum products.

Why not try CHEMIGUM, then, for solving your tough rubber problems. You can quickly and easily obtain full details, samples and the latest *Tech Book Bulletins* by writing Goodyear, Chemical Division, Akron 16, Ohio.

CHEMICAL
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DIVISION

Rubber
& Rubber Chemicals
Department

Chemigum, Plioflex, Pliolite, Plio-Tuf, Pliovic –T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

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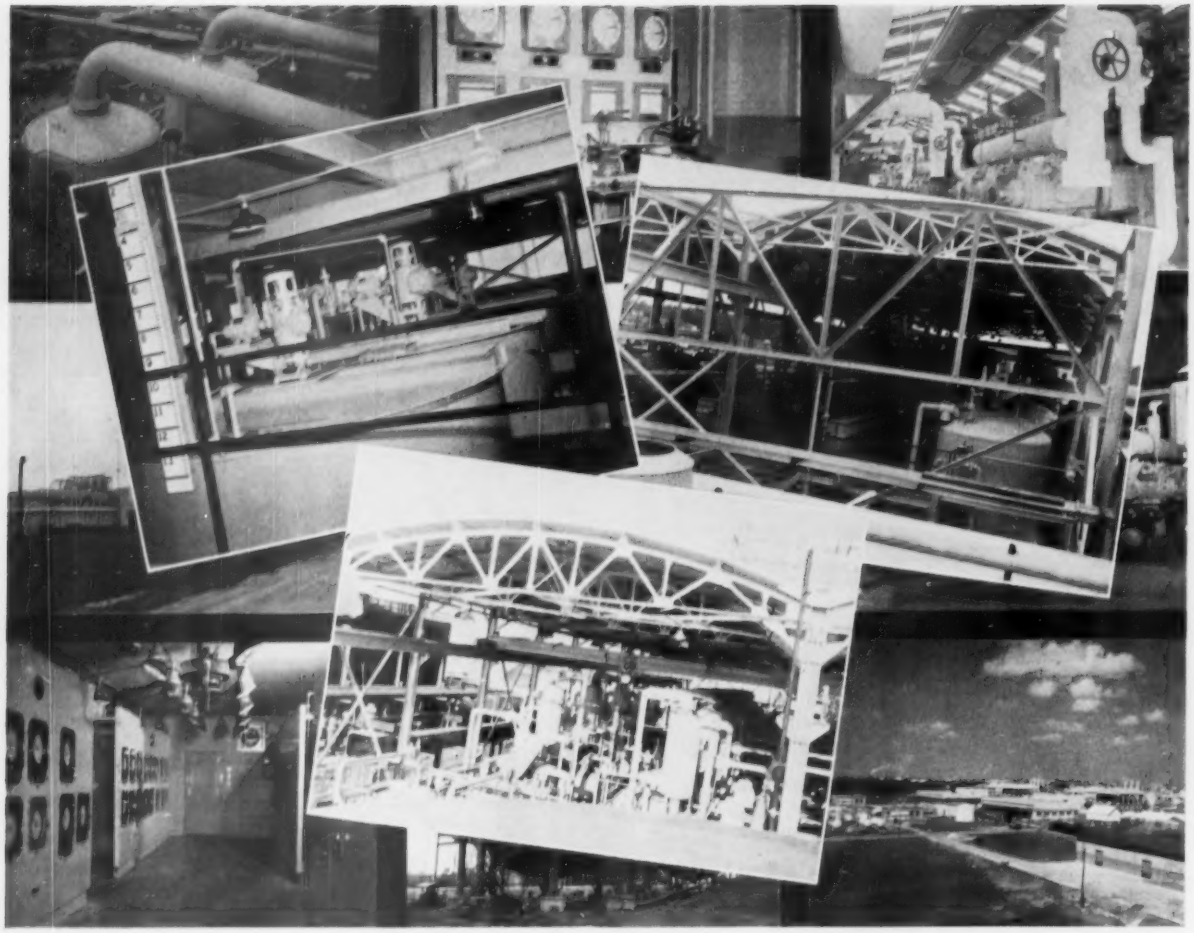
High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries



# Here's big news, even for Texas!

During its days of Government ownership, the synthetic rubber plant in Houston, Texas, was big and efficient. But since Goodyear assumed ownership in 1955, even the eyes of Texas have been opened by the big changes taking place. For today, with completion of a 50% expansion, the Houston facility has become the world's largest single synthetic rubber plant – and the most modern, too.

What this expansion means to you and the rest of the nation is not only the availability of 220,000 long tons of PLIOFLEX rubbers each year, but the supply of even finer PLIOFLEX rubbers. Continuous polymerization plus the installation of considerably larger reactors, much bigger blending facilities and a more centralized, more accurate system of polymerization controls clearly spell greater quality control and a more uniform product.

This $10,000,000 expansion was undertaken for two basic reasons: First, to provide an adequate answer to the increased demand for the current top-quality PLIOFLEX rubbers. And second, to assure sufficient production facilities for the new, even finer, PLIOFLEX rubbers to come. To find out how the Houston plant and its products, both present and future, fit into your plans, write for details including the latest *Tech Book Bulletins*, to: Goodyear, Chemical Division, Akron 16, Ohio.

CHEMICAL
GOODYEAR
DIVISION

RUBBER & RUBBER CHEMICALS DEPARTMENT

Chemigum, Plioflex, Pliolite, Plio-Tuf, Pliovic – T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

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for
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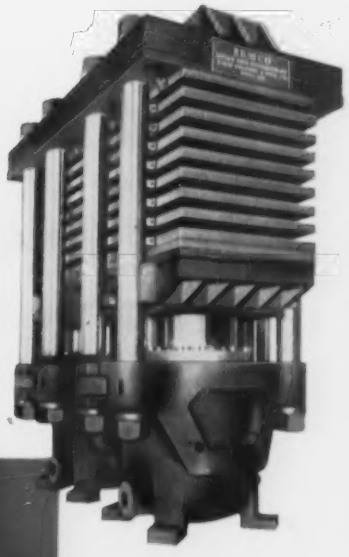
LOWER
COSTS

COMPRESSION MOLDING PRESS

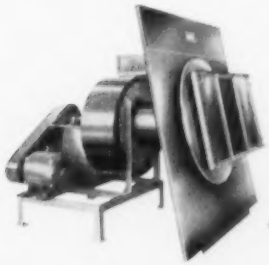


LAMINATING PRESS

# ERIE ENGINE & MFG. CO.
# RUBBER and PLASTICS
# PROCESSING MACHINERY

*EEMCO also designs and builds Mills in standard or custom units, from laboratory mills up to 84 inch mills.*

Erie Engine & Mfg. Co. designs and builds presses for compression, transfer, laminating, and reinforced plastics molding, plus a complete line of mills. EEMCO presses are built in any tonnage, stroke, daylight or platen size, and any closing speed to fit your particular needs. Pumping units, if desired . . . engineered to fit your operation, with automatic or semi-automatic controls. One press or several . . . large or small . . . EEMCO can supply you promptly and dependably with heavy or light duty rubber and plastics processing machinery . . . tailored to fit the job.



Roving Cutters, Fiberglass Preform Machines, Curing Ovens, Up or Down-acting Presses, and Electric Hydraulic Power Units for processing Reinforced Plastics.

*Let us quote on our standard units or build to your specifications.*

FIBERGLASS PREFORM MACHINE

DOWNWARD ACTING REINFORCED PLASTICS PRESS

**ERIE ENGINE & MFG. CO.**

EEMCO

**950 East 12th Street, ERIE, PA.**

***Designers and builders of a complete line of Mills and Hydraulic Presses for the RUBBER, PLASTICS, FIBERGLASS and WOOD PRODUCTS INDUSTRIES.***

1

**NIAGARA FALLS, N. Y.**
50% and 73% Liquid (in tank cars)

# 6 reasons why Mathieson CAUSTIC SODA is always there

2

**SALTVILLE, VA.**
50% and 73% Liquid (in tank cars)
76% Solid, Flake, Granular, and Ground (in drum shipments)

. . . an Olin Mathieson plant is near you.

. . . your source of supply is constantly backed up by five other plants.

*For specifications and schedules, call your Olin Mathieson sales representative.*

3

**HUNTSVILLE, ALA.**
50% and 73% Liquid (in tank cars)
50% Liquid (in barges)

4

**BRUNSWICK, GA.**
50% Liquid (in tank cars and barges)

5

**McINTOSH, ALA.**
50% and 73% Liquid (in tank cars)
50% Liquid (in barges)

6

**LAKE CHARLES, LA.**
50% and 73% Liquid (in tank cars)
50% Liquid (in barges and tankers)
76% Solid and Flake
(in drum shipments)

MATHIESON

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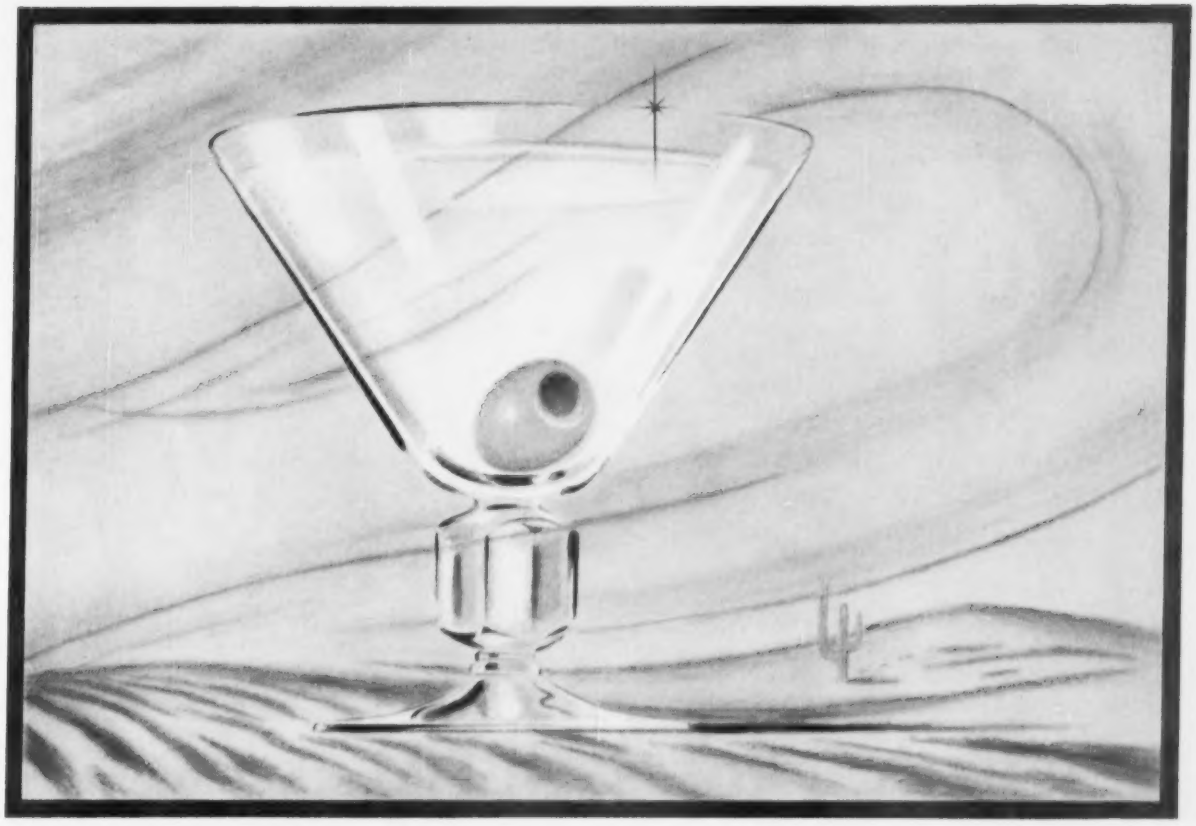
4920

# Naugatuck NAUGAPOLS



## dry!

## and they stay dry!

SPECIALLY PROCESSED for *low moisture absorption!* That's why Naugatuck Chemical's NAUGAPOLS® offer you 5 big advantages over ordinary grades of butadiene-styrene (R-S type) synthetic rubber. Special processing during transformation from the liquid copolymer state produces elastomers characterized by:

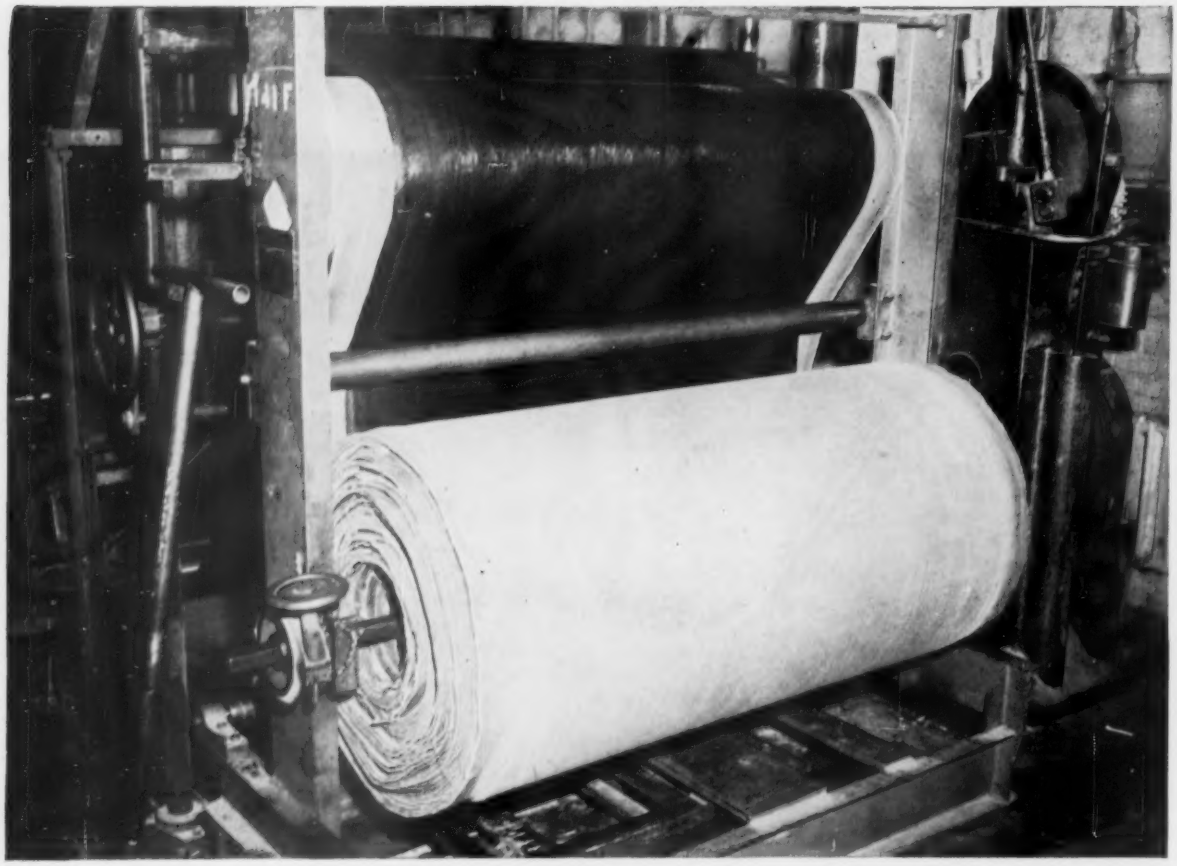
- VERY LOW MOISTURE ABSORPTION
- EXTREME CLEANLINESS AND UNIFORMITY
- HIGH DIELECTRIC PROPERTIES
- LOW ASH CONTENT
- EASY SUBSEQUENT PROCESSING

That's why NAUGAPOLS are so definitely preferred by manufacturers of rubber-insulated wire and cable... and by the makers of specialty mechanical rubber products. If *you* require special grades or special properties in synthetic rubber, let us help you solve your particular problem.

Naugatuck Chemical

**Division of United States Rubber Company**
**Naugatuck, Connecticut**

IN CANADA: NAUGATUCK CHEMICALS DIVISION • Dominion Rubber Company, Limited, Elmira, Ontario • Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices • Cable Address: Rubexport, N.Y.



# CLIMCO PROCESSED LINERS

## Eliminate Adhesions at the Bias Cutter

If your stock has been stored in a Climco Processed Liner, you can depend on easier, faster production, and the stock always separates from the liner cleanly, easily.

And Climco Processed Liners preserve the tackiness of the stock; exclude mould, bloom and sunlight. Rejects and losses due to gauge distortion are sharply reduced.

To speed production and to lengthen liner life, Climco Processing has been accepted in the rubber industry for 31 years. For superior liners, try Climco Processed Liners.

**THE CLEVELAND LINER & MFG. CO.**
**5508 Maurice Ave. • Cleveland 27, Ohio**

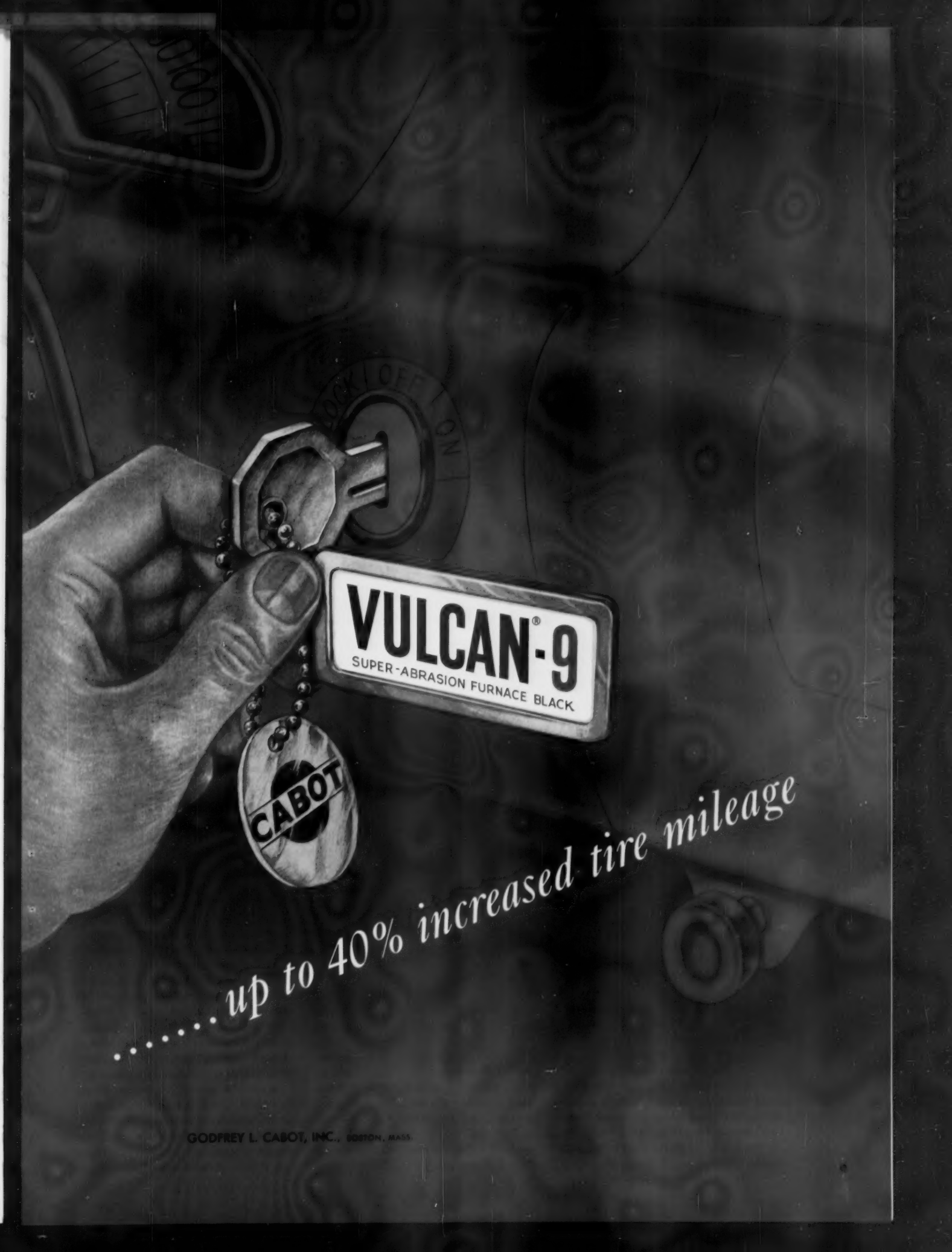
**GET THE FULL STORY ON CLIMCO PROCESSING**

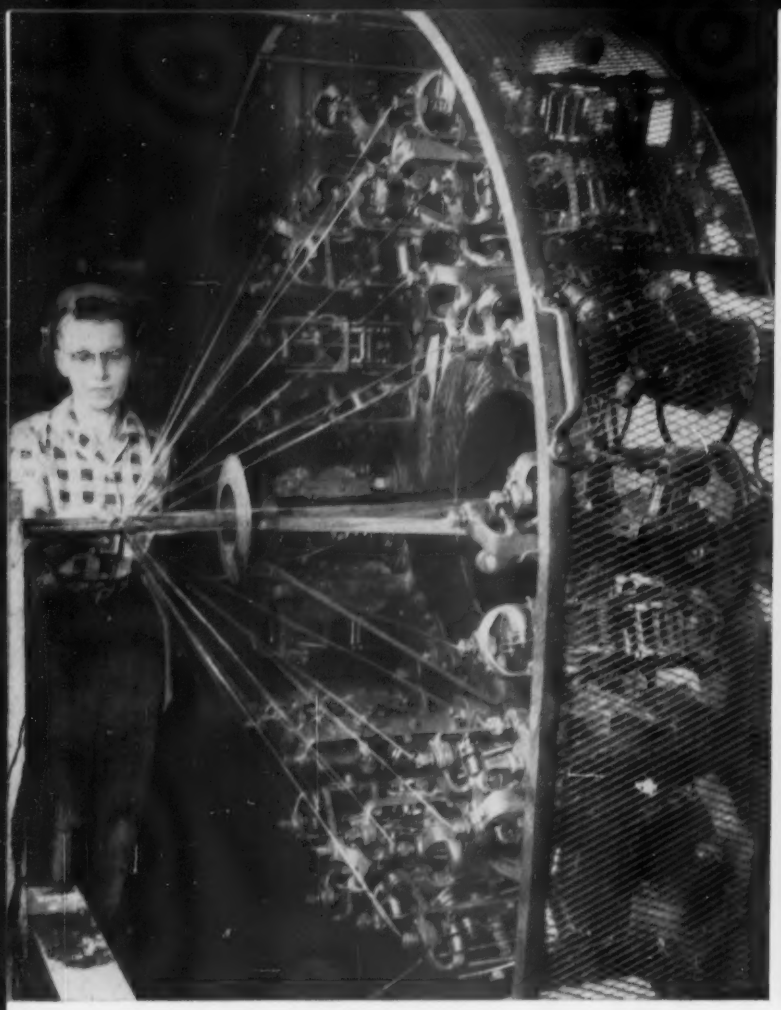
Illustrated booklet tells about Climco Liners and Linerette separating paper. Tells how to get better service from liners. Write for your copy now.

**LINERETTE INTERLEAVING PAPER**
Treatment Contains
**NO OIL OR WAX**
Samples on Request

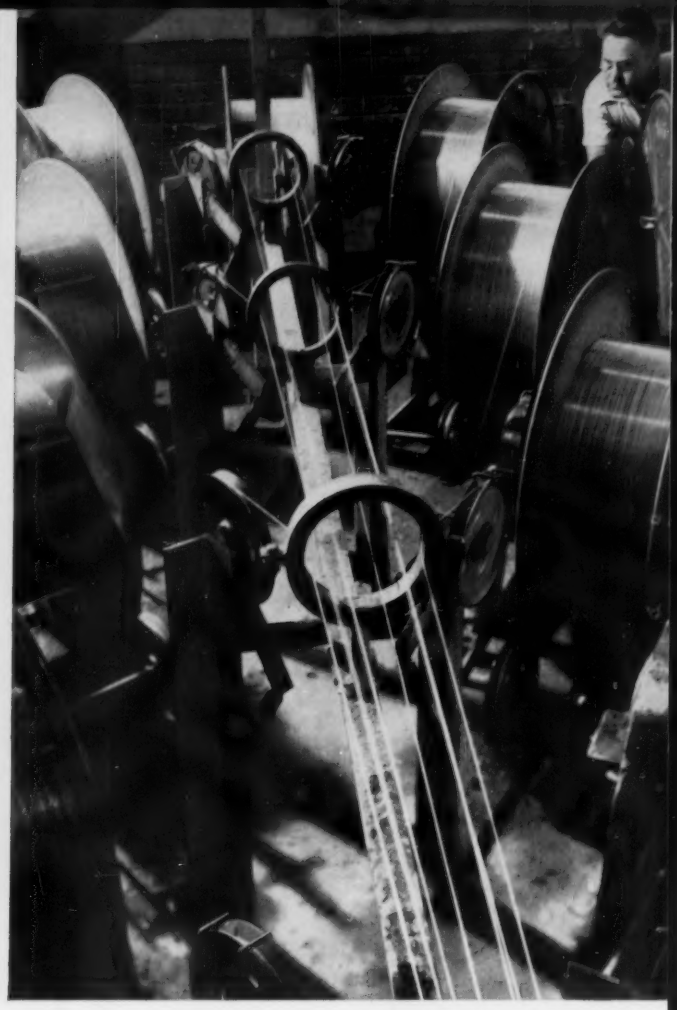
# CLIMCO
## PROCESSED LINERS

*FOR FASTER, BETTER PRODUCTION AT LOWER COST*


VULCAN®-9
SUPER-ABRASION FURNACE BLACK
CABOT
.....up to 40% increased tire mileage
GODFREY L. CABOT, INC., BOSTON, MASS.



**B. F. Goodrich Company** braids multiple strands of steel wire into intricate sinews around rubber tube to help control and resist tremendous internal pressures required of flexible hydraulic hose. Wire such as supplied by Johnson has tensile strengths ranging from 240,000 to 400,000 psi.



**Firestone Tire and Rubber Company** uses only high tensile steel wire of exacting tolerances in building tire beads. Rapidly entering the bead machine in parallel —three to fifteen wires wide, depending on strength specified—the wires are coated with rubber. Clean bronze finish on Johnson wire assures proper rubber adhesion.

# The best names in rubber use Johnson wire for strength and safety in tires and hose

The rubber industry has a sound reputation for producing quality products in advance of its needs by use of imaginative research—painstaking development of production methods—careful selection and testing of component materials.

Goodyear—Firestone—U.S. Rubber—B. F. Goodrich—Thermoid and others have established their names over the years by giving the general public and industry alike—strength, safety and durability in products such as long lasting pneumatic tires and tough pressure hose.

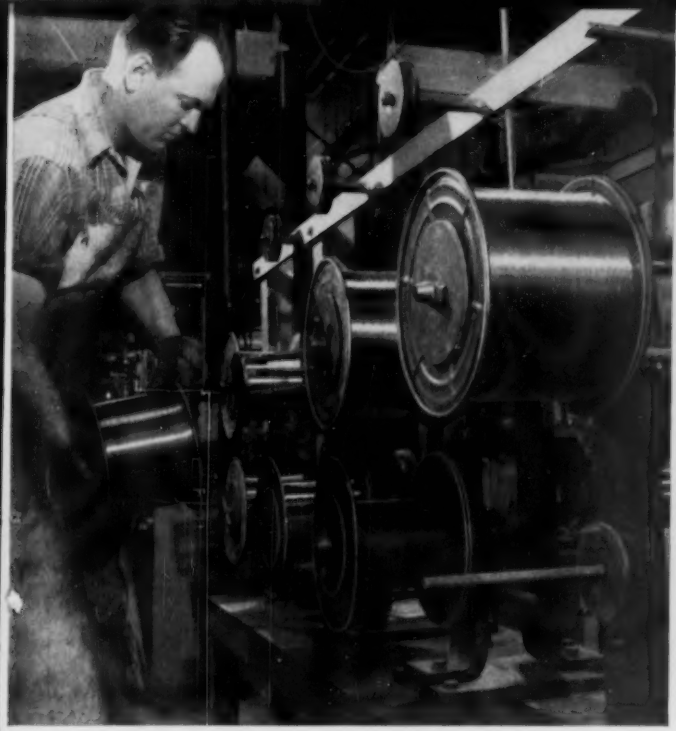
These two products owe their strength in part to the fine steel wires hidden inside them. For it is high-carbon steel bead wire which gives a pneumatic rubber tire—no matter what its size or job, the strength demanded by modern vehicles. Similar wire gives pressure hose its strong sinews which enable it to withstand working pressures as high as 10,000 psi—bursting strength may be three to four times as great.

Take the case of tire bead wire which Johnson supplies to every major tire manufacturer in the country. It is precision-drawn from special high-carbon rods to .037″ in diameter with a tolerance of only .002″—so fine that a 750-pound reel contains 39 miles of wire. Yet, a single strand exceeds 290 pounds of breaking strength equal to a tensile strength of 270,000 psi.

Also the wire must present a clean, unbroken surface and have a good and uniform bronze finish. This finish makes possible tight adhesion between the wire and the rubber surrounding it.

All these qualities contribute to the tire bead strength, help assure the safety of those who ride for work or pleasure on pneumatic tires.

Another special wire made by Johnson for the rubber industry helps rubber hose contain enormous pressures demanded by modern industrial applications. This reinforcing wire is drawn from selected high-



**Thermoid Western Division of Thermoid Company** has cut wire rewind loss to ½ of 1% by use of Johnson Discard-a-Spool which eliminates overlaps and tangles, protects wire quality in shipment. The one-way disposable spool weighs only 28 ounces vs 200 ounces for standard spool—slashes tare weight 14 times.

**United States Rubber Company** wires tires for strength on this bead building machine. The strength comes from the steel wire bead in the edge of each tire. Johnson makes special high-carbon steel wire—.037″ in diameter with tolerance of only .002″ for U.S. and other major tire companies.

carbon steel in diameters ranging from .008″ to .020″ and has exceptional dimensional accuracy—tolerance is plus or minus .0005″.

Johnson hose reinforcement wire is supplied with a special liquor finish to provide maximum adhesion of steel to the rubber which fills the interstices between braids.

The wire is uniformly cast to make possible even spooling and has uniform tensile strength to prevent breaking under the working tension.

These excellent wire qualities, plus careful packaging and prompt delivery, have resulted in Johnson becoming a prime supplier to the rubber industry for hose reinforcement wire.

The outstanding performance of Johnson wire in the rubber industry is typical of the experience in other industries where Johnson supplies aircraft cord wire, armature binding wire, wire for brushes, metal stitching, preformed staple wire, bobby pin wire, rope wire, oil tempered and MB hard drawn spring wire, and music spring wire in a wide variety of sizes and finishes.

If you use specialty wires, call one of the offices listed to right and explore the advantages of Johnson quality which combines strength with economy.

**The Goodyear Tire & Rubber Company** finds that Johnson meets their exacting requirements for tire bead wire which has high tensile strength, twisting strength, elongation and special surface finish. Here parallel tire bead wires uncoil evenly into a bead building machine.

## Johnson Steel & Wire Company, Inc.

Worcester 1, Massachusetts

*a subsidiary of* **Pittsburgh Steel Company**

Grant Building • Pittsburgh 30, Pa.

**District Sales Offices**

| | | | | |
|---|---|---|---|---|
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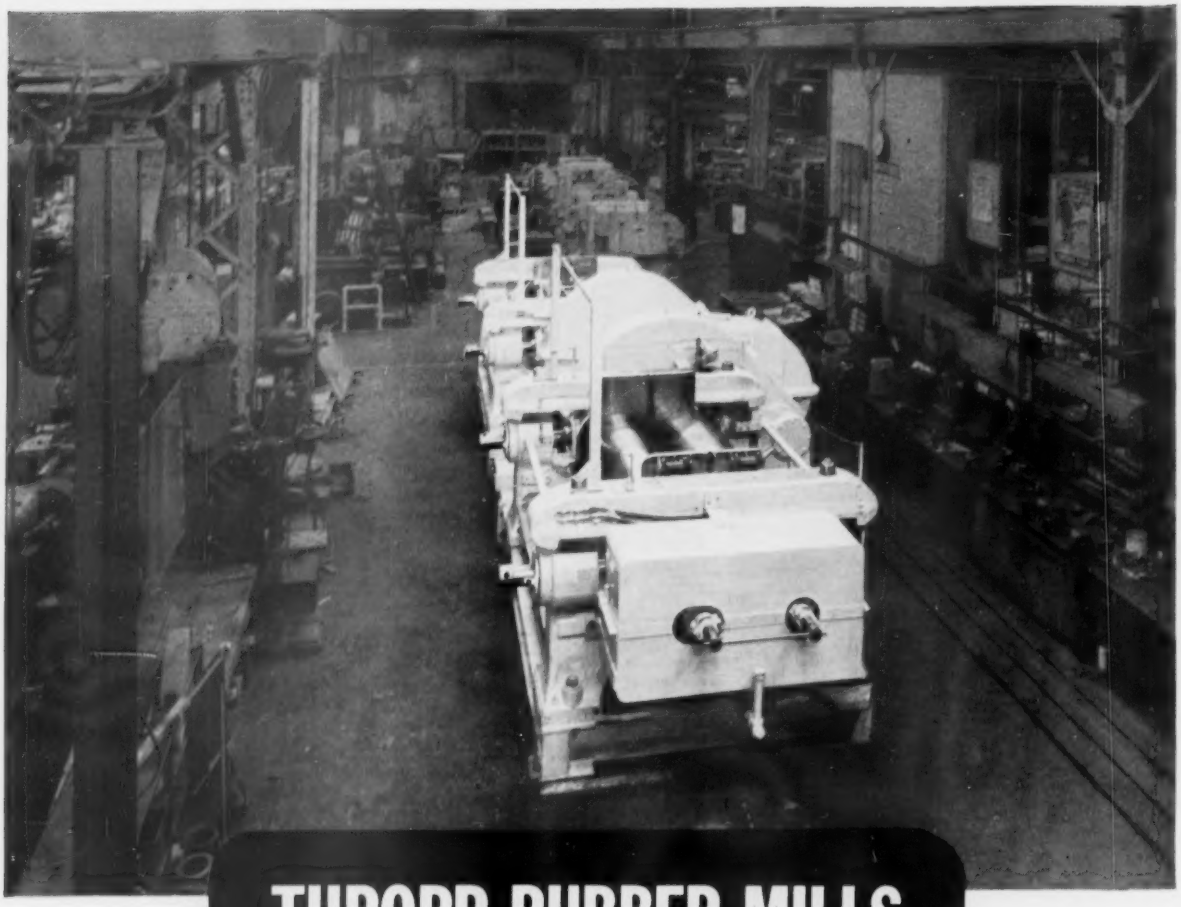
| Chicago | Dallas | Detroit | New York | Tulsa |
| | | Houston | Philadelphia | Warren, Ohio |



# THROPP RUBBER MILLS
## *go overseas*

## ...for B. F. GOODRICH associate companies

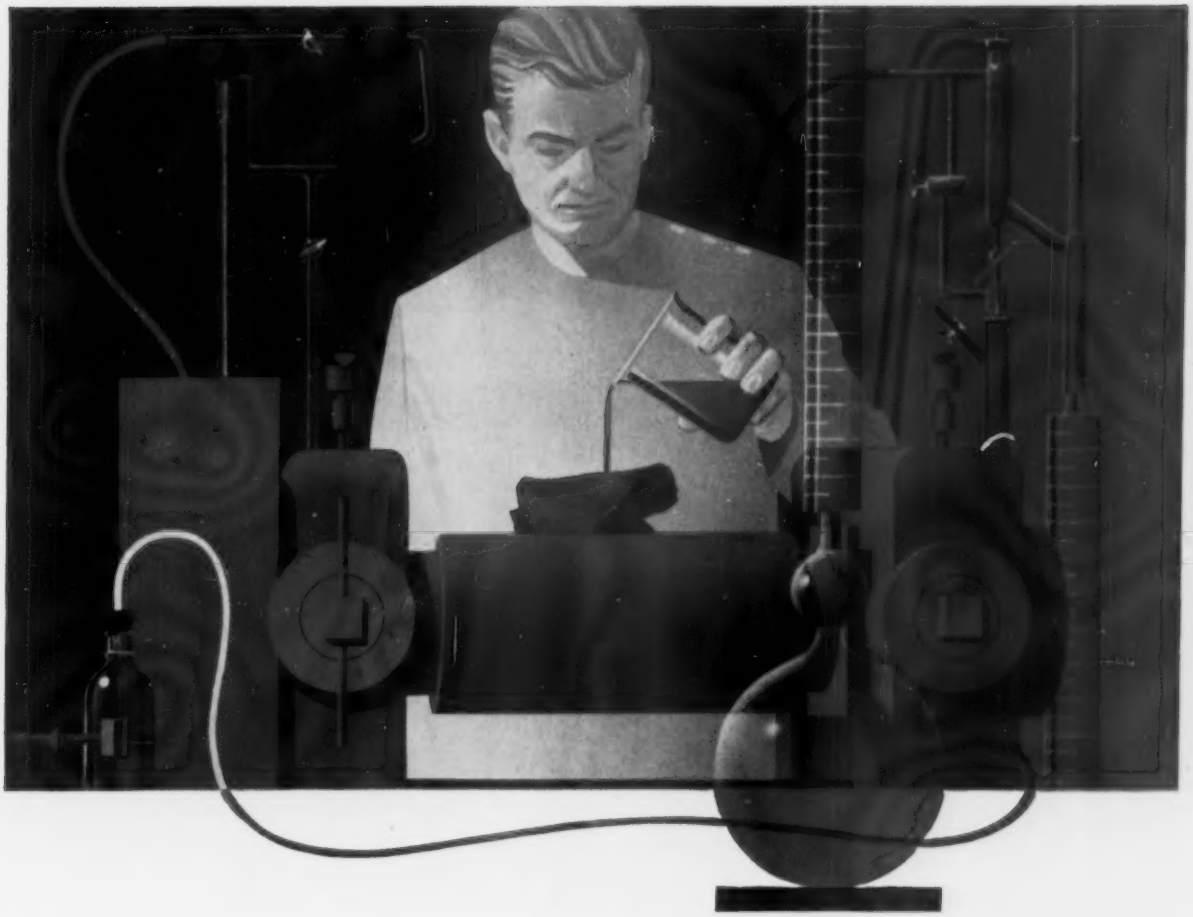
Wm. R. Thropp & Sons manufactured six Twin 26" x 84" Mill Units, like the one pictured, for installation in Peru and Philippines tire plants of B. F. Goodrich associate companies.

Heavy Duty Thropp Mills are designed and built especially to meet the continuous hard service requirements of the Rubber Industry.

**Wm. R. THROPP & Sons**

**Division of J. M. LEHMANN COMPANY, Inc.**

**555 NEW YORK AVE., LYNDHURST, N. J.**



## Our Technical Service Laboratory Will Help You Build Better Products With Neville Resins

If you are not already using Neville coumarone-indene resins in the manufacture of your rubber products, it will pay you to request the assistance of our Technical Service Laboratory. Our chemists will work with yours in choosing the exact grade to suit your need. Neville coumarone-indene resins are ideal extender-plasticizers. They aid processing and add tensile strength and durability to finished compounds. Write for details.

**Neville Chemical Company, Pittsburgh 25, Pa.**

**Resins**—Coumarone-Indene, Heat Reactive, Phenol Modified Coumarone-Indene, Petroleum, Alkylated Phenol • **Oils**—Shingle Stain, Neutral, Plasticizing, Rubber Reclaiming • **Solvents**—2-50 W Hi-Flash, Wire Enamel Thinners.

NEVILLE

Please send information on Neville Chemicals.

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CITY NC 11-RA STATE

# vinyl sentinel

**QUALITY** is worth guarding. Quality materials – like the bright, clear sheeting for this handbag – sell for more. So guard the quality of your vinyls with Argus stabilizers and plasticizers. Argus products are the industry's standard.

Whatever your vinyl formulation problem, Argus can supply you with a stabilizer/plasticizer system to give just the qualities you need – in the mix or in the finished material. Tell us your problem. We'll send appropriate technical bulletins and samples.

Two new Argus stabilizers – Mark WS and Mark C – have just been developed for special calendering operations. Ask us about them.

**ARGUS CHEMICAL** CORPORATION / New York and Cleveland

Main Office: 633 Court Street, Brooklyn 31, N. Y. Branch: Frederick Building, Cleveland 15, Ohio

Rep's.: H. M. Royal, Inc., 4814 Loma Vista Ave., Los Angeles; Philipp Bros. Chemicals, Inc., 10 High St., Boston; H. L. Blachford, Ltd., 977 Aqueduct St., Montreal.

# NOW 8¢ PER POUND!

## REDUCED HI-SIL® 233 PRICE WIDENS QUALITY NON-BLACK PERSPECTIVES

The June 1st price reduction on Hi-Sil 233 to 8 cents per pound in carload lots has taken this reinforcing pigment out of the "specialty" class. Now you can definitely save costs with Hi-Sil 233, just when business is most concerned with effecting every cost saving possible.

Combination loadings of Hi-Sil and hard clay are *lower in pound-volume cost* than loadings based on the silicate-type reinforcing pigments. Yet quality can be maintained or actually improved, regardless of whether stocks are natural, GR-S, butyl, neoprene or nitrile rubber.

The just-released Hi-Sil Bulletin No. 14 demonstrates the specifics of these savings. In each test comparison, identical stocks were loaded with Hi-Sil 233—hard clay mixtures and with a silicate-type pigment.

It has become more important than ever before that compounders take a good look at Hi-Sil 233 in relation to a much broader range of rubber products, whether brightly colored, transparent, or black. We invite your request for our technical bulletins and for help on individual formulation problems. Please address Room 1929A at Pittsburgh, or any district sales office.

**COLUMBIA-SOUTHERN CHEMICAL CORPORATION**
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
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DISTRICT OFFICES: Cincinnati • Charlotte
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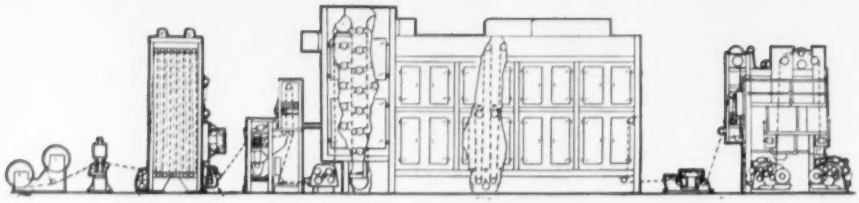
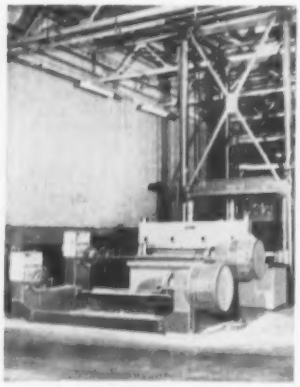
IN CANADA: Standard Chemical Limited
and its Commercial Chemicals Division

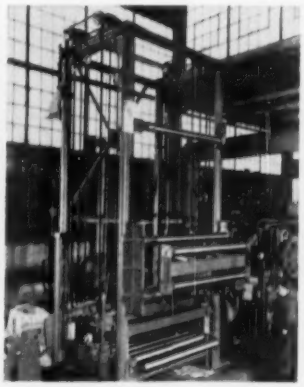
# AETNA-STANDARD ENGINEERING



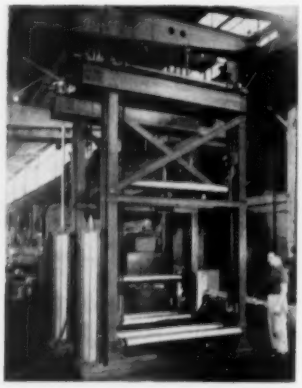
Complete Calender Lines, Parts or Accessories . .



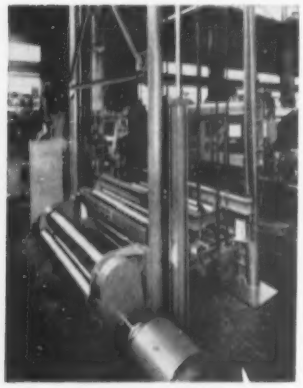
Dual Fabric Letoff



Accumulator & Fabric Guide Assembly



Compensators



Tension Rolls

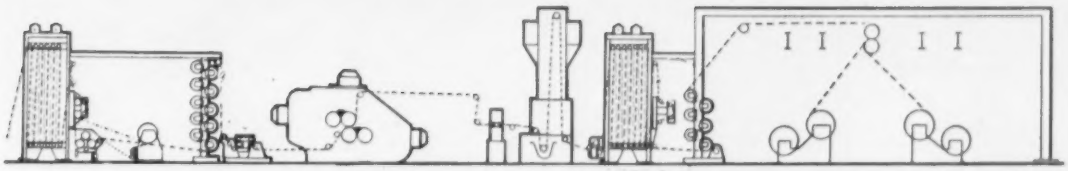
## NYLON HOT-SETTING EQUIPMENT:

The patented high efficiency infra-red method can be furnished in Aetna equipment for the hot-setting of nylon tire cord fabric. True uniformity of heat and exposure time under variable speed conditions is one of the features of this equipment. Units can be furnished single zone or multi-zone as desired and are suitable for installation in tandem with existing dip units, or calenders. Space requirements are held to a minimum.

## PRE-DIP EQUIPMENT:

Pre-dip equipment by Aetna incorporates the latest developments in saturating equipment, positive uniform excess dip removal and high efficiency air handling in the drying oven. Accurately controlled tensions are maintained throughout the process. Designs minimize cleaning requirements and provide complete accessibility for roll maintenance.

# EQUIPMENT for processing TIRE FABRIC



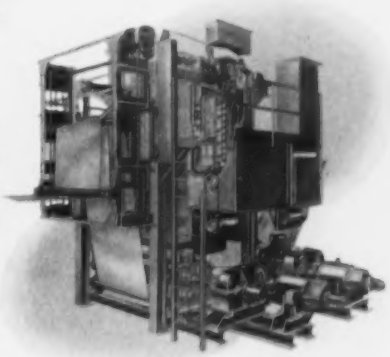
. . including latest type Nylon Hot Stretch Unit

## EQUIPMENT TO DELIVER UNIFORM FABRIC

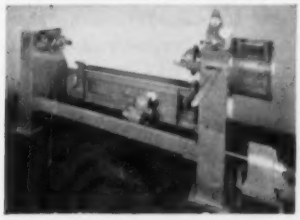
*to your specifications*

● Each processing line is designed to suit your particular requirements. Devices are available to control end count of the fabric, and to accurately guide the material to attain the utmost in uniformity. Accurate tension control equipment and uniform heating and drying are obtained by advanced designs.

Individual units such as roll stands, letoffs, windups, storage and festoon compensators can be furnished for existing lines. All equipment is designed for the **heavy duty** requirements of the Rubber Industry.



Nylon Hot-Setting Machine



Combination Windup & Letoff

Tension Roll Stand

Tension Control Stand

*Complete Service on Rubber and Plastics : Specialized Process : Engineering, Design and Machines*

*Sales and Engineering by*

**HALE and KULLGREN, INC.**

*P. O. Box 1231 · AKRON, OHIO*

*MANUFACTURED BY*

**THE AETNA-STANDARD ENGINEERING CO., PITTSBURGH, PA.**

*PLANTS IN WARREN, OHIO · ELLWOOD CITY, PA.*

# for **shoe soles** and **top lifts...**

## **DUREZ** resins **aid** in compounding ...**improve** the physical properties of **GR-S rubber** stocks

It doesn't take much! From 5 to 15 parts of a Durez phenolic resin impart just the required amount of boardiness and stiffness to the cured stock. Compounding is easier due to the plasticizing effect of the resin while in the molten stage.

Being thermosetting, the hardness and stiffness of the compound are not materially affected by elevated temperatures. Such compounds containing these Durez resins prevent distortion under the heat and pressure encountered in the sole-attaching operation. The spreading of top lifts due to heat and pressure during use is eliminated. The abrasive resistance of these compounds is also improved.

Whether you are working with GR-S, Buna-N, natural rubber or Neoprene... producing compounded stocks or solvent-type adhesives...Durez resins may help to solve your problems of performance and costs. Let us send you the current edition of our bulletin on Resins for the Rubber Industry.

DUREZ®

Phenolic Resins that Fit the Job

**DUREZ PLASTICS DIVISION**

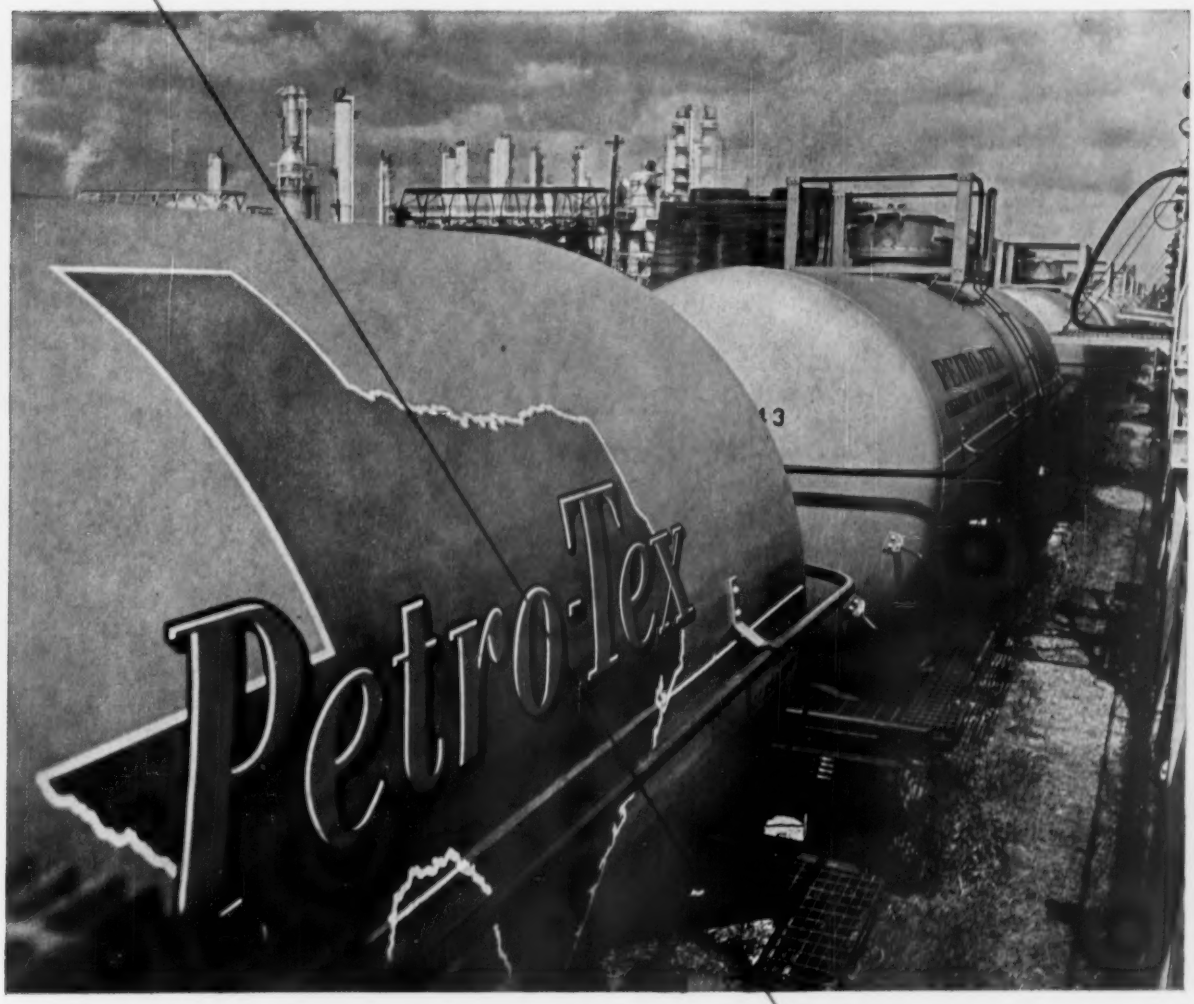
HOOKER ELECTROCHEMICAL COMPANY

106 WALCK ROAD, NORTH TONAWANDA, N. Y.

*Export Agent:* Omni Products Corp., 460 Fourth Avenue, New York 16, New York

HOOKER CHEMICALS PLASTICS

*new butadiene cars, too!*




To keep pace with new production now coming on stream, we have substantially enlarged our fleet of modern tank cars. And to serve both rubber and chemical industry customers even more effectively, we are now completing a modern Research Laboratory and Pilot Plant at our Houston headquarters.

Largest non-captive producer of butadiene and related hydrocarbons, we welcome discussion of your potential needs for butane-derived petro-chemicals.

**PETRO-TEX CHEMICAL CORPORATION**

HOUSTON 1, TEXAS

JOINTLY OWNED BY

TENNESSEE GAS TRANSMISSION COMPANY AND FOOD MACHINERY AND CHEMICAL CORPORATION

# Now! LIGHT-COLORED RUBBERS

These light-colored 1703, 1707 and 1708 SYNPOLS, made with the new TEXUS non-volatile pale oil, offer unprecedented opportunities for the economical manufacture of many *new* light-stable, white, bright and pastel-colored rubber products, such as shoe soles, floor tile, toys, code wire and a variety of mechanical goods.

# with no need to change your compounds

## New improved 1703, 1707 and 1708 SYNPOLS answer the need for fast, high-temperature processing rubbers in light-colored products

TEXUS offers light-colored 1703, 1707 and 1708 SYNPOLS which are *100% interchangeable* . . . number for number . . . with the dark-colored oil rubbers of the same types. These new improved SYNPOLS can be substituted in the most critical formulas, with confidence that their volatility, curing characteristics and physicals of the vulcanizates will not differ from the same grades of dark-colored rubbers, which you may now be using.

The rubber compounder need change no more than the polymer name in his formula book . . . except, perhaps, for a change in pigment to take advantage of the white and pastel colors these new improved SYNPOLS make possible.

### NEW DEVELOPMENT

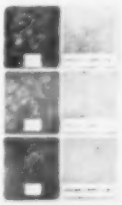
These light-colored, oil-extended polymers are made possible by the development of a new, non-volatile pale naphthenic oil, used exclusively in TEXUS SYNPOLS. For the first time, the advantages of light-color and fast, high-temperature processing have been combined! And the light color is retained in the vulcanizates even after extreme and prolonged exposure to sunlight and heat.

The complete interchangeability of these new TEXUS SYNPOLS offers you two important advantages.

*Eliminates need for extensive formula testing or compound adjustment.* Extensive factory tests and their current use in product manufacture by present TEXUS customers minimize or eliminate your need of testing when adopting these new light-colored, oil-extended polymers.

*Eliminates need for costly double inventory.* Use of the new improved SYNPOLS gives you added flexibility of operation because they can be easily used for a wider variety of products . . . some which may not require light color as well as those in which light color *and* fast, high-temperature processing are important.

Find out how your product line can benefit from the new SYNPOLS by calling or writing your TEXUS representative today.



### THE CASE FOR SYNPOLS

This convincing comparison case shows the new 1703, 1707 and 1708 SYNPOLS side by side with dark rubbers of the same numbers. Your TEXUS representative would like to show it to you and to give you complete information on the entire line of SYNPOLS.

TEXUS

***Sales Agent:***
***Naugatuck Chemical***
***Naugatuck, Conn.***

***Plants and General Offices:***
***Texas-U. S. Chemical Co.***
***Port Neches, Texas***

## TEXAS-U. S. CHEMICAL COMPANY

**260 Madison Ave., New York 16, N. Y.**

# DI-CUP KEEPS WHITE STOCK WHITER

First introduced commercially last year, Hercules Di-cup (dicumyl peroxide) has already become well established as a curing agent that improves whiteness and color retention of white stock formulations.

Because Di-cup does not contain sulfur and will not discolor, white stock is whiter from the very beginning. And Di-cup's outstanding color retention keeps the finished product white longer despite exposure to the sun.

A stable peroxide of low volatility, Di-cup gives good retention of elongation, modulus, and tear strength on aging. It also provides low compression set in vulcanizates of natural rubber and most synthetic elastomers.

For more information on this versatile and economical curing agent, send for new data sheet.

**DI-CUP®**

*Oxychemicals Division • Naval Stores Department*

**HERCULES POWDER COMPANY**

INCORPORATED

*914 Market St., Wilmington 99, Del.*

N057-6

**Sales are lost, product acceptance damaged, when ozone cracking shows up even on new products.**

You can give your product dependable protection from ozone cracking, from the day it's made till the day it's discarded even under the most extreme conditions, with Universal's high potency rubber antiozidants, UOP 288 and UOP 88.

To tires, or any other rubber product, natural or synthetic, these Universal antiozidants provide complete protection under both static and dynamic exposure.

To be sure your product presents the quality appearance you built into it, when it comes face to face with a potential customer, let us recommend the correct UOP antiozidant formulation to give it complete protection from ozone cracking.

**UOP 88® and 288** TRADEMARK

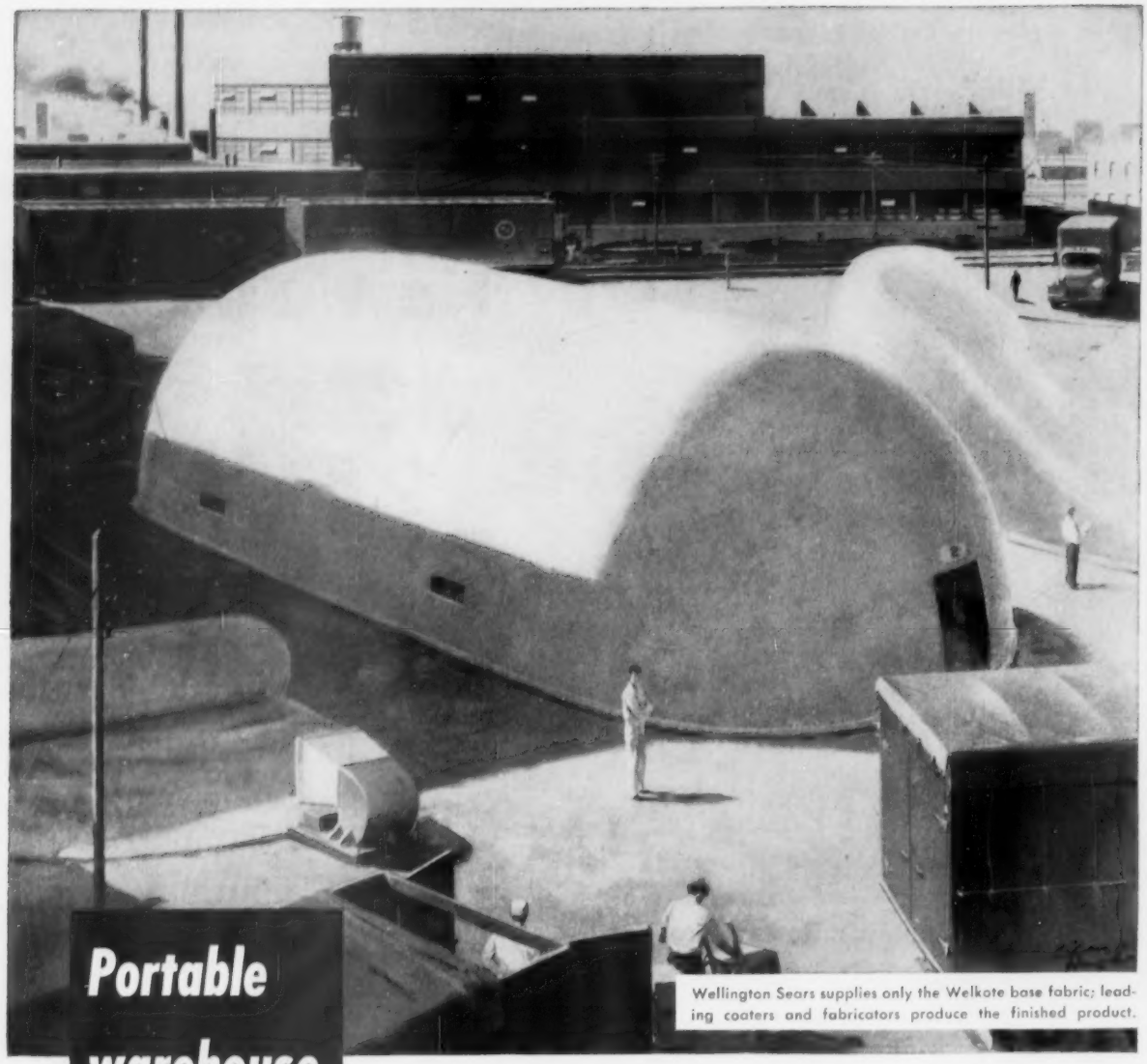
**RUBBER ANTIOZIDANTS**

UOP®

PRODUCTS DEPARTMENT

**UNIVERSAL OIL PRODUCTS COMPANY**

30 ALGONQUIN ROAD
DES PLAINES, ILLINOIS, U. S. A.



Wellington Sears supplies only the Welkote base fabric; leading coaters and fabricators produce the finished product.

# Portable warehouse made of fabric "lives" on air!

No visible means of support: *air* does it! Now huge vinyl-coated nylon buildings can be easily packed, transported swiftly to a site, inflated on the spot, and start receiving goods for storage in a matter of hours. And constant, regulated air pressure keeps walls and roofs taut even when doors are open!

As in so many new industrial uses of textiles, the rugged nylon base fabric, *Welkote*, is produced by the mills of West Point Manufacturing Company and supplied by Wellington Sears. Welkote is engineered specifically as a base for vinyl and neoprene coating, and is just one aspect of our textile service to all kinds of industries, for all kinds of uses. We've been doing this for more than a century. Surely you can use this experience to help in solving *your* fabric problems!

For informative booklet, "Fabrics Plus," write Dept. G-6.

## Wellington Sears

**FIRST In Fabrics For Industry**

*For Mechanical Goods, Coated Materials, Tires, Footwear and Other Rubber Products*

WEST POINT TEXTILES

WEST POINT MANUFACTURING CO.

Wellington Sears Co., 65 Worth St., New York 13, N. Y. • Atlanta • Boston • Chicago • Dallas • Detroit • Los Angeles • Philadelphia • San Francisco • St. Louis

Day and night a carefully controlled flame burns at Witco-Continental plants to produce furnace and channel blacks particularly suitable for the rubber industry. Complete laboratory analysis further insures uniform performance – and conformity to customer specifications.

Your nearest Witco office can give you full information and service on these industry-proved blacks.

Witco-Continental

**CARBON BLACKS**

**Furnace Blacks**

Continex® SRF – Semi-Reinforcing
Continex SRF-NS – Non-Staining
Continex HMF – High Modulus
Continex HAF – High Abrasion
Continex FEF – Fast Extruding
Continex ISAF – Intermediate Super Abrasion
Continex CF – Conductive Furnace

**Channel Blacks**

Continental® AA – (EPC) – Witco No. 12
Continental A – (MPC) – Witco No. 1
Continental F – (HPC) – Witco No. 6
Continental R-40 – (CC) – Conducting

*37 Years of Growth*

**WITCO CHEMICAL COMPANY**
**CONTINENTAL CARBON COMPANY**

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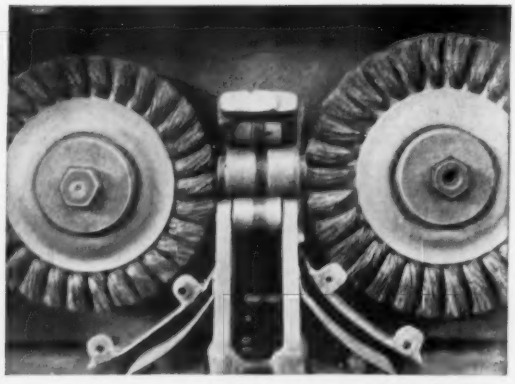
OSBORN BRUSHING METHODS *worthy of your confidence*



**Osborn Disc-Center® Brushes,** *8" diameter are used to remove flash from mechanical rubber parts, efficiently, economically.*

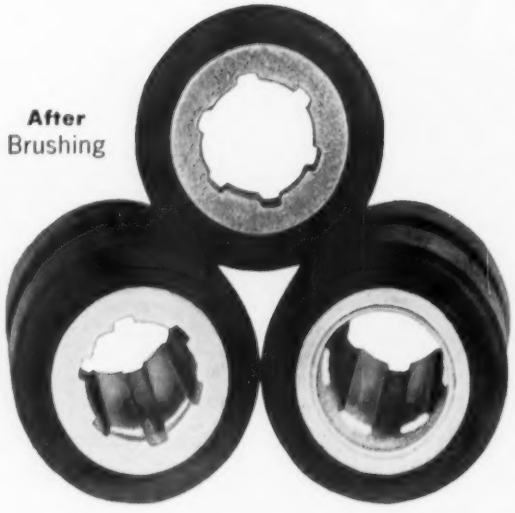
# Removing flash...IN A FLASH!

REMOVING flash from mechanical rubber parts by hand was a slow and costly operation before Osborn power brushing methods took over.

With this simple set-up using Osborn Disc-Center® Brushes, a major rubber company has increased production 800% . . . and cut its costs substantially. Results are uniform . . . production consistent throughout the day.

This case is typical of how Osborn power brushing can improve your finishing operations and simplify your methods.

An **O**sborn **B**rushing **A**nalysis, made at no obligation in your own plant, will demonstrate how you can save time and money. Write *The Osborn Manufacturing Company, Dept. j-11, 5401 Hamilton Ave., Cleveland 14, Ohio.*




Osborn Brushes

Write TODAY for the new 100-page Osborn Catalog 210-C.

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY PRODUCTION MACHINERY

## Another first from Monsanto

# SULFASAN* R...a non-discoloring vulcanizing agent—for part replacement of curing agents—that makes possible bloom-free nitrile and butyl stocks with good physical properties

**SULFASAN R**—quite simple to use and quite unique. Created by Monsanto's Rubber Chemicals Department, this vulcanizing agent is a sure-fire remedy for bloom on nitrile and butyl formulations. And more than this, Sulfasan R gives a high degree of safety from scorch and excellent aging characteristics.

But most significant today, rubber shops turning out Buna N and butyl rubber mechanical goods are finding that Sulfasan R is a tremendous boon. While bloom seldom affects the rubber part's performance, it does hurt its appearance. When a nice, smooth gloss on dispensing hose, cable insulation, appliance parts, gloves and aprons contributes to the appearance of quality—a nonblooming composition is a must. Use of Sulfasan R can stop—right now—customer complaints about "dullness."

Sulfasan R is a Monsanto development; chemically, it is 4,4' -dithiodimorpholine. It is added in the range of 1 to 2 parts on the formulation; conventional vulcanizing agents are cut back—usually by the same amount as the Sulfasan R added. This addition of Sulfasan R imparts the following benefits:

**Freedom from bloom**
**Excellent aging**
**Resistance to scorch**

And Sulfasan R is non-discoloring; it can be used in white and light-colored stocks.

For more information on Sulfasan R and guidance on formulating, write or call Monsanto.

**Accelerators**—*For fast, slow, and regulated rates of safe cure.*

**Antioxidants**—*For maximum oxidation resistance.*

**Plasticizers**

**Specialty Processing Materials**

This stock bloomed: 100 parts nitrile rubber, 5 zinc oxide, 1.0 stearic acid, 40.0 FEF black, 3.5 Thiurad.*

No bloom. Stock same as above except Thiurad reduced to 1.5 parts . . . and 1.5 parts of Sulfasan R added.

*Reg. U. S. Pat. Off.*

MONSANTO

MONSANTO CHEMICAL COMPANY
Rubber Chemicals Department
Telephone: HEmlock 4-1921, Akron 11, Ohio

# TESTED PROVEN

IN ACTUAL USE

## STABILITE WHITE

### NON-STAINING NON-DISCOLORING ANTIOXIDANT

Since its introduction to rubber compounders, Stabilite White has proven itself again and again in actual use. Users report that this mobile liquid* Non-Staining, Non-Discoloring Antioxidant possesses maximum age-resisting properties, is easy to handle, has sun-light and flex-cracking resistance, and the ultimate in non-staining characteristics. Our customers also report that these properties are obtained at NO INCREASE in compounding costs. YOUR recipes — whether for crude rubber, natural or synthetic — can profitably be converted to include STABILITE WHITE . . . the PROVEN non-staining antioxidant.

*ALSO AVAILABLE IN POWDER FORM

The C. P. Hall Co.
CHEMICAL MANUFACTURERS

MANUFACTURED BY CHEMICO, INC.
THE C. P. HALL CO. *Manufacturing Agents*

AKRON, OHIO ★ LOS ANGELES, CALIFORNIA ★ CHICAGO, ILLINOIS ★ NEWARK, N. J.

# National NADONE*

(CYCLOHEXANONE)

- By the drum from nearby stocks
- By the tank car from Hopewell, Va.

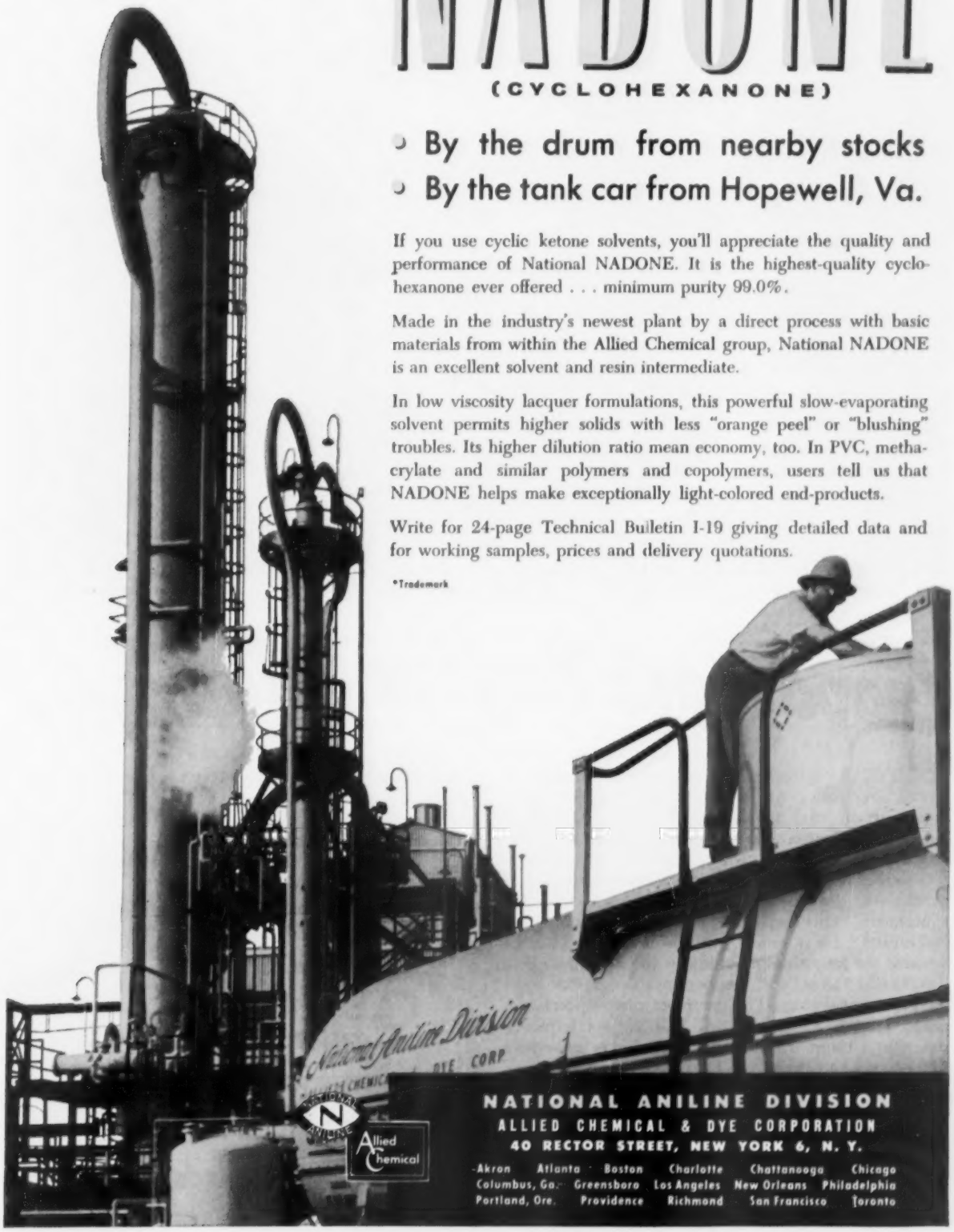
If you use cyclic ketone solvents, you'll appreciate the quality and performance of National NADONE. It is the highest-quality cyclohexanone ever offered . . . minimum purity 99.0%.

Made in the industry's newest plant by a direct process with basic materials from within the Allied Chemical group, National NADONE is an excellent solvent and resin intermediate.

In low viscosity lacquer formulations, this powerful slow-evaporating solvent permits higher solids with less "orange peel" or "blushing" troubles. Its higher dilution ratio mean economy, too. In PVC, methacrylate and similar polymers and copolymers, users tell us that NADONE helps make exceptionally light-colored end-products.

Write for 24-page Technical Builetin I-19 giving detailed data and for working samples, prices and delivery quotations.

*Trademark

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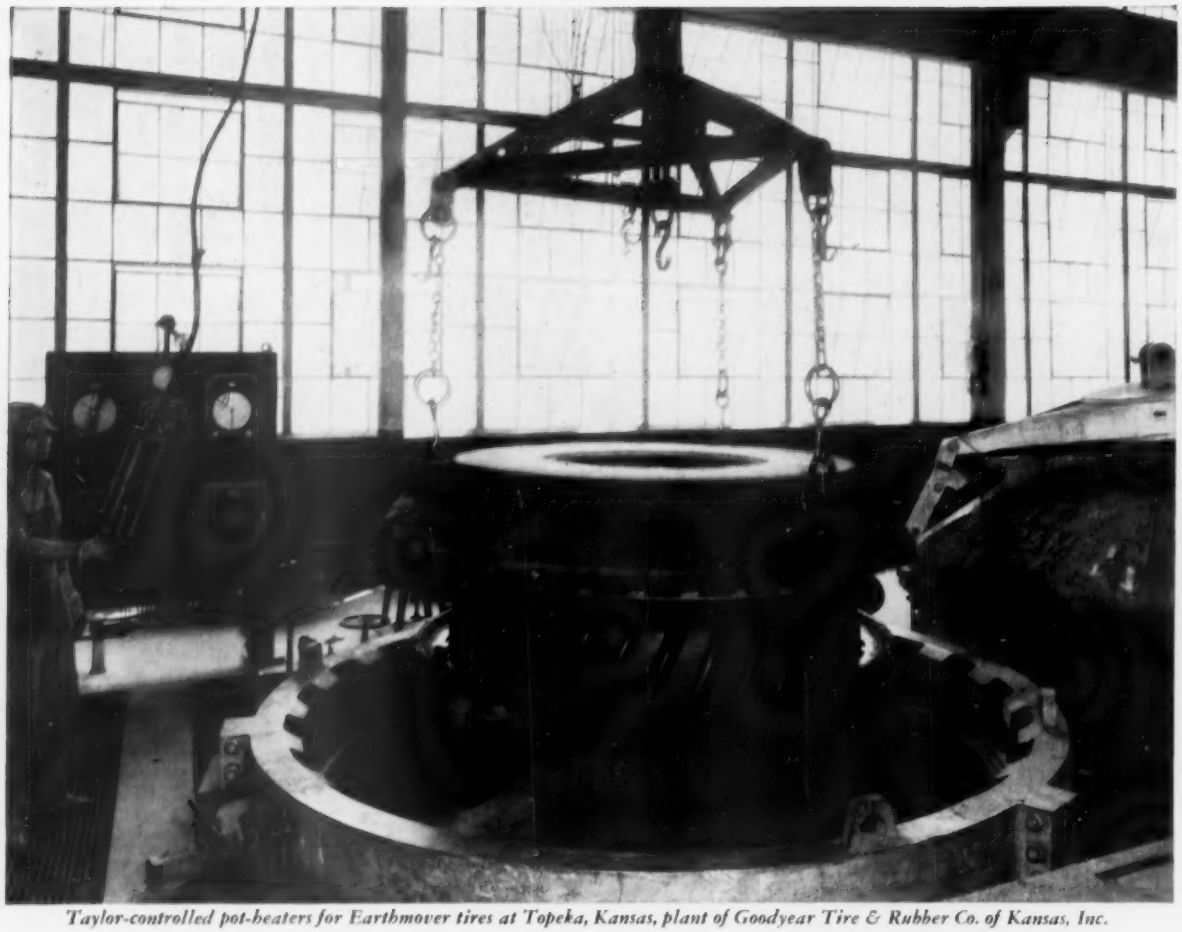


*Taylor-controlled pot-heaters for Earthmover tires at Topeka, Kansas, plant of Goodyear Tire & Rubber Co. of Kansas, Inc.*

# Goodyear's tougher with Taylor

GOODYEAR "Earthmovers" are tougher because of Taylor precision controls on their pot-heaters. That's important because these 1600-lb. tires must carry mammoth loads and travel at speeds unknown to old-fashioned earth-moving equipment.

Goodyear officials say: "Properly controlled cure of Earthmover tires has first preference in the design of equipment." This meant ±1 degree in temperature . . . this meant ±1% in time . . . this meant Taylor Control Systems for fully automatic timing and temperature.

A Taylor FULSCOPE* Temperature Controller regulates the temperature. The complete cure is precision-timed by two Taylor FLEX-O-TIMERS*—a sequence timer for a range from two to 192 minutes and a cure timer having a range from 18 to 1,440 minutes.

## THIS FULLY AUTOMATIC TIMING MEANS:

**1. Improved tire quality**—the automatic cure cycles *are uniform.*

**2. Improved plant efficiency**—automatic cure timing permits *closer scheduling of heats,* reduces idle time of equipment and operators.

**3. Reduced processing costs**—there's *no need for a "steam-tender"* to time curing stages.

The man to suggest what Taylor Control Systems can mean in your plant is your Taylor Field Engineer. Or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

*Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.*

*Reg. U.S. Pat. Off.

**Taylor Instruments**
**MEAN**
**ACCURACY FIRST**
**IN HOME AND INDUSTRY**

# Are you always "putting out fires?"

Frequent crises in production lines can quickly consume the profits. Picco products are always standing by to fill your processing needs. The wide variety of thermoplastic resins and solvents produced by Pennsylvania Industrial Chemical Corporation are readily available to "put out fires" in your production lines.

**PICCOPALE**—petroleum polymers
**PICCO RESINS**—para-coumarone indene
**TRANSPHALT**—low cost dark colored resins
**OILS**—aromatic and semi-aromatic high boiling oils
**PICCOLYTE**—poly terpenes
**PICCOLASTIC**—low molecular weight styrenes
**PLASTICIZERS**—aromatic poly olefins
**MODIFIED STYRENE COPOLYMERS**—substituted styrene copolymers
**SOLVENTS**—water white aromatics

There is a Picco Sales-Chemist near you—phone, wire, or write the office most convenient for you.

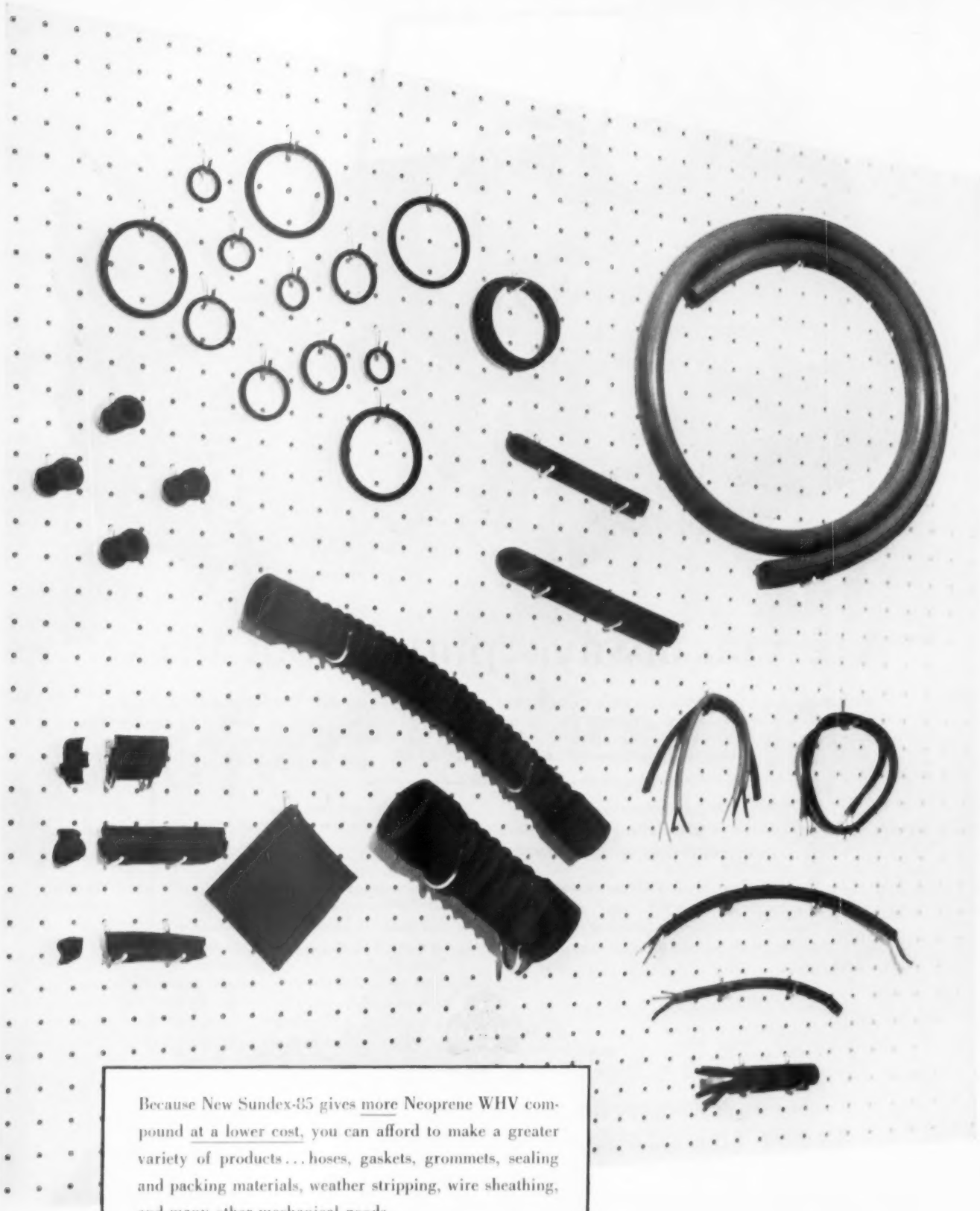
PENNSYLVANIA INDUSTRIAL CHEMICAL CORP.

*Clairton, Pennsylvania*

Plants:
Clairton, Pa.; West Elizabeth, Pa.; and Chester, Pa.

Sales Offices:
Atlanta, Boston, Chicago, Cincinnati, Cleveland, Detroit, Jacksonville, Los Angeles, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, San Francisco

*Distributed by:* HARWICK STANDARD CHEMICAL COMPANY, Akron 8, Ohio



Because New Sundex-85 gives more Neoprene WHV compound at a lower cost, you can afford to make a greater variety of products... hoses, gaskets, grommets, sealing and packing materials, weather stripping, wire sheathing, and many other mechanical goods.

# NEW SUNDEX-85 CAN GIVE YOU MORE PRODUCT PER POUND OF NEOPRENE WHV

By using high loadings of new Sundex®-85, you can lower the cost of your Neoprene WHV compound and still retain the properties that make neoprene outstanding for oil-resistant mechanical goods.

As much as 100 parts of Sundex-85 to 100 parts of neoprene hydrocarbon have been used successfully. Sundex-85 also conditions the compound for easy handling during processing.

Even with unusually high loadings of Sundex-85, neoprene products maintain their high resistance to oil, grease, ozone, heat, and sunlight. It helps assure quality in oil-resistant automotive and industrial hose, sealing and packing materials, gaskets, grommets, and other molded goods where cost is a strong factor.

Sundex-85 is compatible with neoprenes, natural rubber, butadiene-styrene type, and acrylonitrile polymers. Here are some of its typical properties:

| | |
|---|---|
| Viscosity, SUS at 210F | 90 |
| Specific gravity at 60F | 1.017 |
| Refractive index, $n_D^{20}$ | 1.5869 |
| Aniline point, deg F | 90 |
| Color | Dark |

**FOR COMPLETE INFORMATION** about Sundex-85, ask your Sun representative, or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. RA-6.

SUNOCO®

© Sun Oil Company

**INDUSTRIAL PRODUCTS DEPARTMENT**

## SUN OIL COMPANY PHILADELPHIA 3, PA.

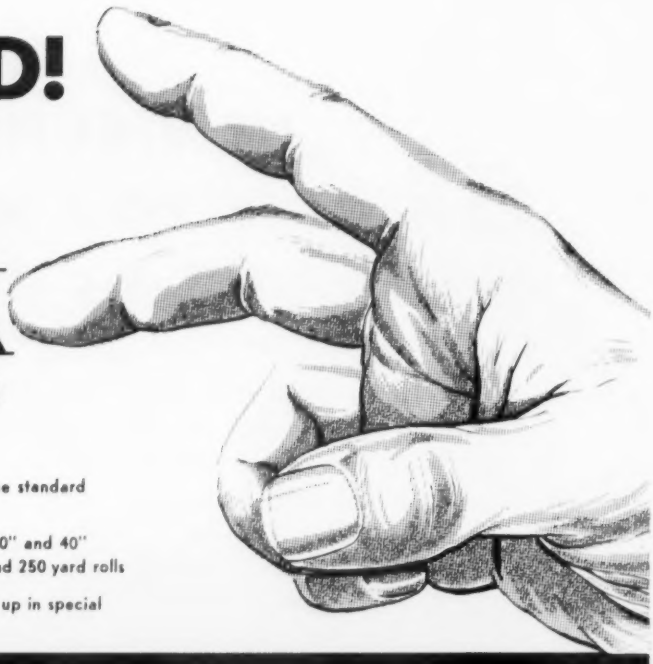
IN CANADA: Sun Oil Company Limited, Toronto and Montreal • IN BRITAIN: British Sun Oil Company Ltd., London W.C.2, England • THE NETHERLANDS: Netherlands Sun Oil Company, Rotterdam C, The Netherlands • WESTERN EUROPE (except the Netherlands), NEAR EAST, NORTH AFRICA: Sun Oil Company (Belgium) S.A., Antwerp, Belgium.

# HOT or COLD!

**whichever you use in your manufacturing processes**

## HOLLISTON BRATEX RUBBER HOLLAND

**is the correct solution!**



- ★ combines strength with pliability
- ★ clean peeling and non-flaking
- ★ uniform caliper with outstanding surface gloss
- ★ comes in three standard qualities
- ★ available in 20" and 40" widths, 100 and 250 yard rolls
- ★ can be made up in special size rolls

**THE HOLLISTON MILLS, INC., NORWOOD, MASS.**

NEW YORK • PHILADELPHIA • CHICAGO • MILWAUKEE • SAN FRANCISCO

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# NEW for Neoprene

# Thiate A

**accelerator**

*for safe processing fast curing compounds of all types*

Samples and technical information on its uses in Neoprene compounding for press or CV vulcanization are available on request.

## R. T. Vanderbilt Co., INC.

230 Park Avenue
New York 17, N.Y.

# more crystex!

## *insoluble . . . non-blooming*

Crystex®, Stauffer's unique 85%-insoluble Sulfur, is now available in greatly increased quantities from our plants at Chauncey, New York and Monongahela, Pennsylvania.

A new form of Crystex, thoroughly dispersed with 20% oil to increase dispersibility in mixing and to reduce fire hazard in handling, is now available. We shall be glad to send samples.

If you have not received a copy of "Stauffer Sulfurs", ask us to send one. It is a 52-page brochure, richly illustrated, on the history, uses, mining and refining of Sulfur. Many useful tables are included.

## *research program:*

Stauffer is conducting an extensive research program on wettable, aqueous paste and oil paste forms of Crystex. Data on compatibility, thermal reversion rates, plastic properties, and direct application to many products and processes will presently be available. If we can include inquiries of particular interest to you, please address . . .

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Prudential Plaza, Chicago 1, Illinois

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P.O. Box 9716, Houston 15, Texas • 326 So. Main St., Akron, Ohio

Stauffer CHEMICALS SINCE 1885

## HOW THE SILICONES MAN HELPED...

### BUILD THE PATTERN OF A TIRE TREAD

Tire tread designs are patterns with a purpose. Years of research by the tire industry has proven every slot, every angle to be the most efficient . . . to offer the most in road holding with a minimum of wear. This is no small contribution to safer, surer transportation.

Those thousands of thin grooves are difficult to make . . . still, they provide the "biting edge" for safe stops. Molded in standard equipment with extremely thin section molds, the grooves are made possible because of the easy release properties of UNION CARBIDE Silicones. And, production is increased, rejects are reduced. One manufacturer, after eight years of experience, states: "Silicones reduce blemishes on treads, permit complicated treads not possible without silicones, and eliminates mold cleaning."

This is another example of how the UNION CARBIDE Silicones Man has helped solve an "impossible" problem . . . why UNION CARBIDE is one of the leading suppliers of silicone release agents for the rubber industry. For details, contact our distributor, C. P. Hall Co., with offices in Newark, N. J., Chicago, Ill., Akron, Ohio, Memphis, Tenn., and Los Angeles, Calif., or write Dept. RA-6, Silicones Division, Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y.

UNION CARBIDE TRADE-MARK SILICONES

The term "UNION CARBIDE" is a trade mark of UCC.

*In Canada:* Bakelite Company, Division of Union Carbide Canada Limited, Belleville, Ontario

# *test Horse Head A-420 against your color standards!*

A-420

**TITANIUM DIOXIDE**

(anatase)

How long since you checked your white and tinted rubber color standards?

Horse Head A-420 titanium dioxide is designed to produce brilliant whites and clean tints in rubber products.

It may be just the pigment you've been looking for to give your products that extra note of quality that comes from high tinting strength, excellent color and brightness.

Send in now for a sample of A-420 and compare it against your color standards.

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*Founded 1848*

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*Also Distributed by*

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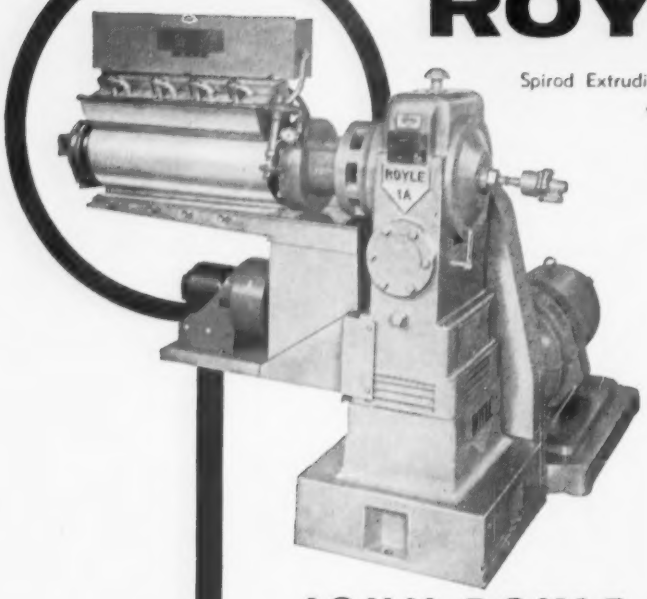
HORSE HEAD PRODUCTS

# ROYLE

**1A (2½" cylinder bore)**




Spirod Extruding Machine with electric heating and high velocity evaporative cooling. An all-purpose extruding machine for processing rubber and plastics.
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**Strainers, Cooling Troughs, Light Wire and Cable Capstans, Motorized Take-ups, Temperature Control Units.**

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**THE STAMFORD RUBBER SUPPLY COMPANY, STAMFORD, CONN.**

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In Glidden Mercadmolith and Cadmolith Colors, you get a combination of advantages found in no other red or yellow pigments. They are soft and easy to grind, insoluble in all vehicles, resistant to alkalies and acids, opaque, and high in heat resistance.

When used as the sole pigment, Mercadmolith or Cadmolith Colors assure permanency of color . . . enhance it when used for shading or tinting. Both are available in the same five shades of red and are interchangeable. Cadmolith Colors also are available in four shades of yellow.

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# LATEX FOAM?

## In the West—make it from SHELL SYNTHETIC RUBBER

If you make or contemplate making foam rubber products, you will be glad to know that a new unit to produce cold high solids butadiene-styrene latices has just come on stream at Torrance.

Shell Chemical's newest Latex S-2105 has excellent uniformity, color and aging properties. It is ideal for latex foam, carpet backing adhesives and other applications where a high-solids latex is required.

In addition to latices, a full line of butadiene-styrene solid type rubber is available to fulfill the requirements of Western manufacturers, large and small.

Convenient location and diversity of product make Torrance your logical Western source for synthetic rubber. Important, too—Shell's Technical Service Laboratory is ready to help you find practical solutions for troublesome technical problems.

Think of Torrance, California, whenever you need synthetic rubber in solid types or liquid latices. Our phone number in Los Angeles is Faculty 1-2340.

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Synthetic Rubber Sales Division
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SHELL

# Capitol Cues

THERE'S A NEW UNDERCURRENT OF OPTIMISM about the business outlook that has developed in just the past few weeks. It seems to confirm all the confidence in the economy's strength expressed throughout the first-quarter doldrums by top analysts in industry and the government. Part of the better feeling is seasonal—reflecting the normal Spring pick-up. But much of it comes from growing realization that the U.S. is NOT heading for a recession.

The signs are becoming fairly numerous. The stock market has shown some new life, recovering much of earlier losses. Money is getting a little tighter. Officials of the various Federal Reserve Banks say many businessmen are talking expansion again. The new feeling has been helped along by the fact that first-quarter profits of corporations were a pleasant surprise; they were up 6-8% over a year ago—instead of lagging as expected. In addition, the latest government figures show that personal incomes, business sales, and production hit peaks last Winter.

HERE'S THE SIZE-UP FOR THE REST OF '57 as the government's leading economists now see it. In their view, the current plateau in production and sales will continue through the Summer—possibly with some very small gains. In the Fall, though, there should be a noticeable pick-up in business tempo. The year as a whole is expected to end up as a slightly better one than 1956.

What will spark the pick-up? The fact that consumers, business firms, and federal, state and local governments have not cut down their demand for goods. So it's only a matter of time till retailers and industrial purchasing agents stop buying hand-to-mouth and start adding to their inventory holdings again.

PRICES WILL KEEP RISING ALL THROUGH THE YEAR, even during the period in which business activity will stay level. Some of the hikes will be big. For one thing, wage costs are still climbing. For another, the hold-downs on inventories have cleaned up excess supplies that were depressing prices. Finally, delayed effects of past hikes at wholesale must still work through.

At wholesale, prices will be up 3% or 4%.
- Steel will be up 4%...$5-$6 a ton; non-ferrous metals, 1-2%.
- Machinery (including components) will reflect the steel hike.
- Textiles will see small dips in cottons, some rise in woolens.
- Chemicals would increase 4% or 5% in price, on the average.
- Farm items will rise 3%, the rate of gain slowing at year end.

On the Consumer Price Index, prices will rise 2-3% by Winter.
- Food will climb 2%, meats and processed fruits moving most.
- Clothing will be mixed—shoes and woolens up, cottons down.
- Furniture will see increases of 2% or 3%, rugs somewhat more.
- Appliances will show mixed trends. Tags should be higher on sewing machines and air conditioners, lower on refrigerators.
- Autos will decline about 5% by Fall as dealers discount more. Prices will go up after that, when the 1958 models come out.
- Rents are expected to climb an average of 3%, now to year-end.
- Personal service—hair cuts, medical care, etc.—will rise 3%.

*Continued on Next Page*

TIME HAS RUN OUT ON SOME KEY PROGRAMS now pending before Congress. The lawmakers are behind schedule. They spent too much time on cutting the Budget, on investigating, and on squabbling over things like civil rights.

Out of the picture for this year are these major programs:
•Natural gas—Exemption of producers from federal regulation.
•Minimum wages—Extending rules to trade and service workers.
•Price discrimination—Limiting good faith as a justification.
•Curbs on mergers—Pre-notification to the Justice Department.
•Welfare funds—Federal regulation of financial practices.
•Civil rights—Federal vote guarantees and a study commission.
Some of these measures are good bets to be voted next year.

A BIGGER SMALL BUSINESS ADMINISTRATION is one thing that the Congress does seem sure to vote before adjournment. SBA will be made permanent, more independent. Loan funds will be doubled—to $500 million—and the limit per borrower may go up from $250,000 to $500,000. Loans will be easier to get.

SBA will also expand its staff and the number of its branch offices. It will also set up an Extension Service—like that available for farmers—to advise on management and production.

DISPOSAL OF SURPLUS FEDERAL PROPERTY would be governed by a new set of rules, under a policy being drafted by several Washington agencies. It would set a pattern for handling factories, real estate, typewriters, etc.—items worth billions in all. Now, agencies have to keep going to Congress to renew authority to dispose. But the new program would make it permanent.

Most items would be sold at auction or by competitive bidding, after extensive advertising. But private negotiations would be permitted on the bigger transactions. Only where real estate is concerned would brokers be permitted to seek out customer prospects on a commission basis, as in private transactions. Other assets would be sold through "normal channels of trade."

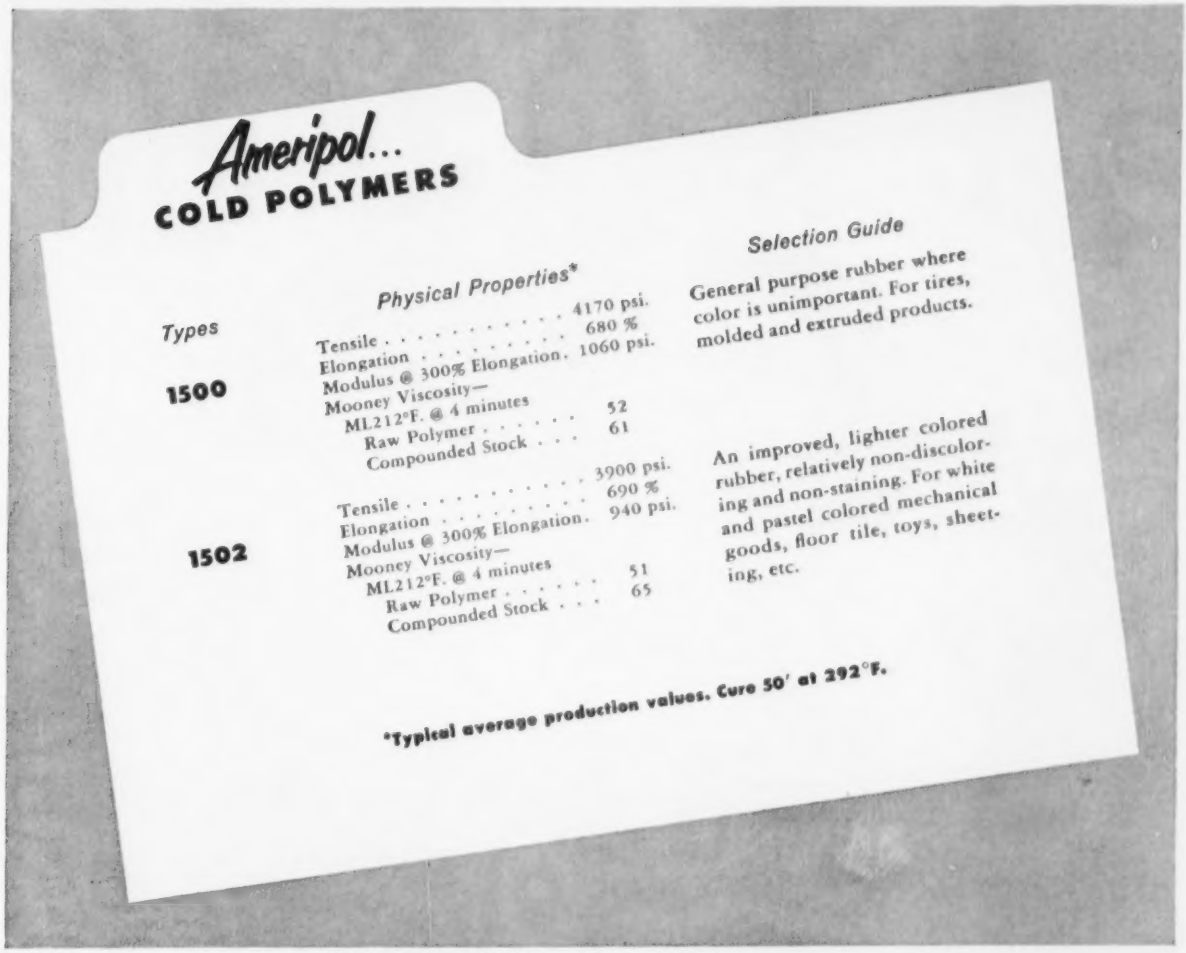
HOW LONG SHOULD FINANCIAL RECORDS BE KEPT to meet the requirements of the federal agencies—social security, tax, etc.? A "Guide to Record Retention Requirements" has just been published. It costs only 15¢ and is available from the U.S. Government Printing Office, Washington 25, D.C.

Tax records should be kept for at least three years, experts at the Internal Revenue Service advise. That's as far back as the government usually can go except in fraud cases. The fact that a refund has been received, doesn't bar a later audit.

A SHARP INCREASE IN BANKRUPTCIES is being forecast for this year by federal court officials. The total may rise 16%, with business failures—as distinct from those of farmers, professionals, etc.—going up a bit less. The experts think the rise is not necessarily a sign of worsening business. It's a by-product of growth—more needs...more new ventures...more failures.

These days, it's not the merchants and manufacturers who are sparking the rise in bankruptcies. Relatively, their role is shrinking. Contractors, eating & drinking places, and service enterprises seem to be going bankrupt relatively more often.

# Goodrich-Gulf Chemicals, Inc.


Ameripol...
COLD POLYMERS
Physical Properties*
Selection Guide
Types
1500
Tensile . . . . . 4170 psi.
Elongation . . . . . 680 %
Modulus @ 300% Elongation. 1060 psi.
Mooney Viscosity—
ML212°F. @ 4 minutes
Raw Polymer . . . . . 52
Compounded Stock . . . 61
General purpose rubber where color is unimportant. For tires, molded and extruded products.
1502
Tensile . . . . . 3900 psi.
Elongation . . . . . 690 %
Modulus @ 300% Elongation. 940 psi.
Mooney Viscosity—
ML212°F. @ 4 minutes
Raw Polymer . . . . . 51
Compounded Stock . . . 65
An improved, lighter colored rubber, relatively non-discoloring and non-staining. For white and pastel colored mechanical goods, floor tile, toys, sheeting, etc.
*Typical average production values. Cure 50' at 292°F.

## Choose cold polymer man-made rubber for superior flexing, wear, abrasion resistance

Ameripol is the preferred butadiene-styrene rubber—superior or equal to natural rubber in aging, resistance to wear, weathering, water, oil, permeability to gases.

Of the many types of Ameripol rubber, the cold polymer grades offer the best physical properties where exceptional flexing and loading are involved, and exceptional wear and abrasion resistance required.

**Write for free copy** of 24-page booklet "Ameripol —the preferred rubber". Complete technical data helps you select and specify.

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Cold Non-Oil Polymers
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# for better plastic pigmentation

You can trust TITANOX white pigments with any brightening, whitening or opacifying job in plastics. For the thinnest vinyl sheet or the plumpest children's doll, you can choose the exact pigment for highest opacity, clarity of color, delicate toning or a given brightness.

Our Technical Service Department is available for consultation on any problem of plastic pigmentation. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; offices in principal cities.

**TITANIUM PIGMENT CORPORATION**

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# Philprene*

## can help you with your rubber problems!

Phillips is an acknowledged leader in synthetic rubber research and has years of experience in this field. It was one of the first companies to create specific polymers to meet the needs of manufacturers of various rubber products.

Phillips maintains a fully-equipped, modern technical service laboratory and a staff of scientists and technicians who are constantly seeking new and better ways to serve their customers.

Your Phillips technical representative will be glad to help you with your individual processing problems and recipes. This is a valuable part of our service. Take full advantage of Phillips experience and know-how.

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Phillips 66

| CURRENT PHILPRENE POLYMERS | | |
|---|---|---|
| | NON-PIGMENTED | PIGMENTED WITH PHILBLACK* |
| HOT | PHILPRENE 1000 PHILPRENE 1009<br>PHILPRENE 1001 PHILPRENE 1010<br>PHILPRENE 1006 PHILPRENE 1018<br>PHILPRENE 1019 | PHILPRENE 1100<br>(Pigmented with EPC Black)<br>PHILPRENE 1104 |
| COLD | PHILPRENE 1500<br>PHILPRENE 1502<br>PHILPRENE 1503 | PHILPRENE 1600<br>PHILPRENE 1601<br>PHILPRENE 1605 |
| COLD OIL | PHILPRENE 1703<br>PHILPRENE 1706<br>PHILPRENE 1708<br>PHILPRENE 1712 | PHILPRENE 1803 |

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# In rubber processing, score more hits with SOLKA®-FLOC

Want to make *better* rubber soles, floor tiles, other rubber products? Then it's time to investigate versatile, economical Solka-Floc!

This finely divided wood cellulose reduces blistering and nerve, controls shrinkage, improves dimensional stability. It permits sharper designs and harder, smoother surfaces. It solves your dispersion problems.

Let us show you how it adds sales appeal to your products, scores with the customer, increases your profits. Write to us outlining your specific process problems. Address Dept. FG-6, our Boston office. (Sold in Canada as Alpha-Floc by Brown Forest Products, Ltd., Montreal, Quebec.)

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## CYAN GREEN TONER 15-3100 • CYAN BLUE TONER GT 55-3300 (green shade)
## CYAN BLUE TONER XR 55-3760 (red shade)

No other pigments offer better properties for rubber compounding than the phthalocyanines. Possessing excellent color, good physical and chemical stability, these Cyan toners

- **are easily dispersed**
- **do not affect vulcanization adversely**
- **are non-bleeding and show no migration into uncolored or white stock**
- **are resistant to acid, alkali and soap**
- **have good chemical resistance**
- **possess excellent light fastness and exterior durability**
- **are heat stable**
- **are low in free copper and manganese**

Ask your Cyanamid Pigments representative for full information and samples.

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COLOR IS THE DIFFERENCE

The "mainline" belt system consists of 2 individual conveyors, each approximately 4,000 ft. long pulley to pulley, laid out to meet the irregular terrain. Successive loads from a continuous line of 35-ton dump trucks are required to keep the system feeding at its peak capacity.

Shown here is one of two 72" conveyor belts that carry rock and earth to the lakeside after it has been deposited in a surge pile by the mainline conveyor. These feeders transfer gravel to two recovery conveyors which can fill a 3,200-ton barge in only 15 minutes!

# AN EARTH-MOVING EVENT

This huge 54" conveyor system—nearly two miles long and traveling at speeds up to 850 feet per minute—is the longest downhill conveyor of its kind ever built. Capable of transporting 75,000 tons of material a day, it was manufactured by Hewitt-Robins for Morrison-Knudsen Company, Inc., and is being used to haul 30,000,000 tons of rock and earth required for the foundation of a 13-mile roadbed now under construction across the Great Salt Lake for the Southern Pacific Railroad. The system is equipped with special Hewitt-Robins patented drive mechanisms which not only act as an efficient braking system for the long down-grade, but generate enough electricity to serve 4,000 average homes. The belting itself is more than 23,000 feet long and required for its construction a special Mount Vernon fabric which was delivered to Hewitt-Robins in record time.

This is another example of how fabrics made by Mount Vernon Mills, Inc. and the industries they serve, are serving America. Mount Vernon engineers and its laboratory facilities are available to help you in the development of any new fabric or in the application of those already available.

*UNIFORMITY Makes The Big Difference In Industrial Fabrics*

*Mount Vernon Mills, inc.*

A LEADER IN INDUSTRIAL TEXTILES

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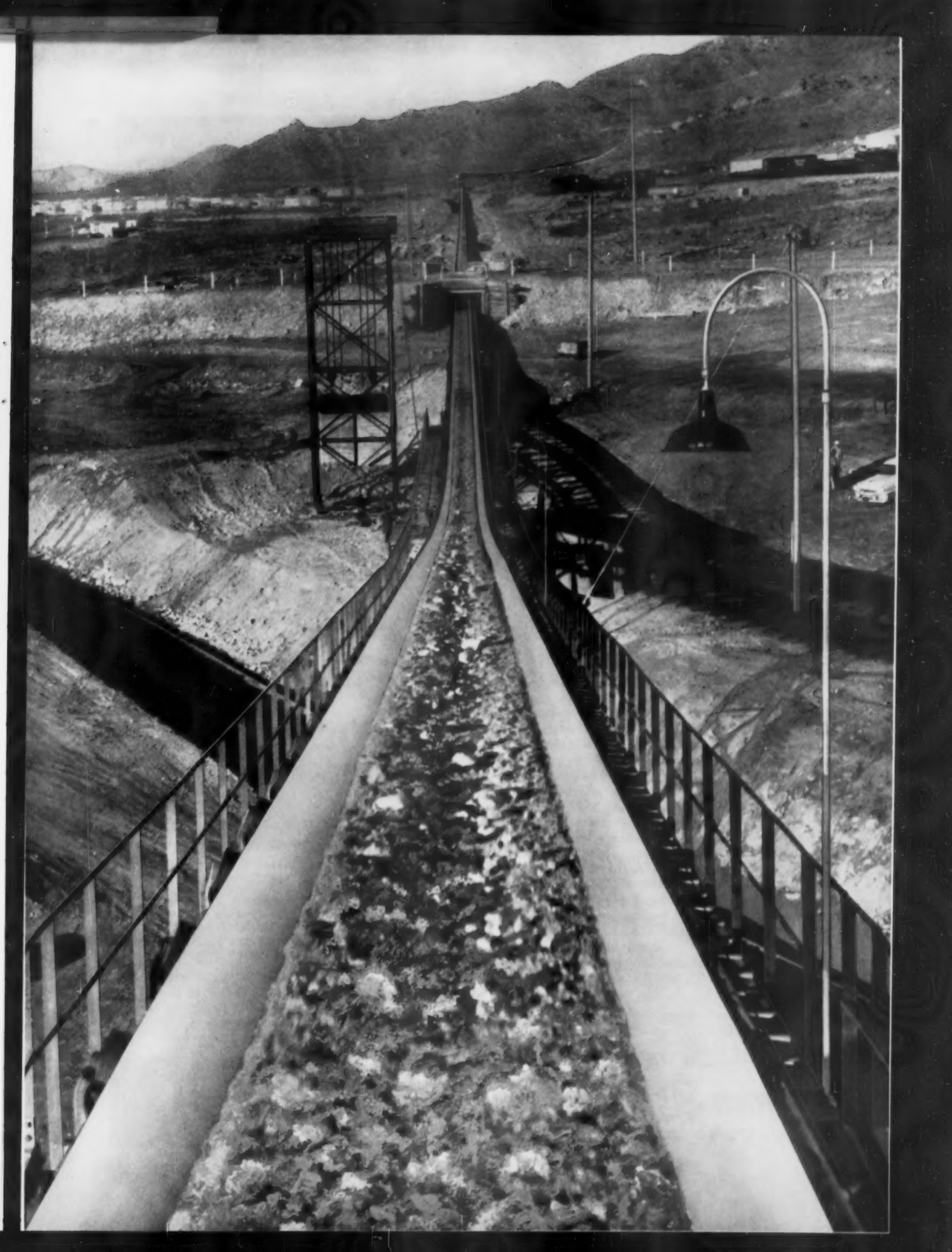

**a production manager's dream comes true**

## *with Borden's C 510 Heat Seal Laminant*

*(for bonding vinyl film to fabric!)*

For a real "eye-opener," take a look at these production advantages! With Borden's C 510, lamination and embossing are accomplished in one pass . . . application by spreader knife is possible any time before lamination . . . there is no unusable off-grade material or scrap . . . small orders can be processed easily without interrupting calender schedules. What's more, C 510 also provides excellent adhesion to cotton, wool, rayon, paper, leather and vinyl film.

Borden's C 510 Heat Seal Laminant is another example of Borden's wide experience as specialty compounders in the industrial coating and adhesive fields. Whether your business is rubber, paper, textile, leather, plastics, automotive or chemical, Borden can offer a complete compounding service to meet your specific requirements. Why not consult with one of our engineers by writing: The Borden Company, Chemical Division, Coatings and Adhesives Dept. RA-67, 103 Foster St., Peabody, Mass. Or to Borden plants in Chicago, Ill., Middlesex, N. J., or Toronto, Canada.

*Adhesive Coatings, Resin Emulsions, Hot Melt Adhesives, Binders, Sizes and Saturants*

IF IT'S A

**Borden Chemical**

IT'S GOT TO BE GOOD!

this is a

# dead load hardness tester with

# I.R.H.D.

- Calibrated in International Rubber Hardness Degrees. (The Standard for vulcanized, natural and synthetic rubbers.)
- This unique tester at last provides a truly accurate and reproducible standard for expressing rubber hardness.
- Dead weight loads — eliminating variables of springs and leverage.
- Vibrating buzzer in base.
- Large, clear dial reads direct in I. R. H. D.
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- Makes foot or base plate type tests.

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*Manufacturers and Distributors for over 30 years.*

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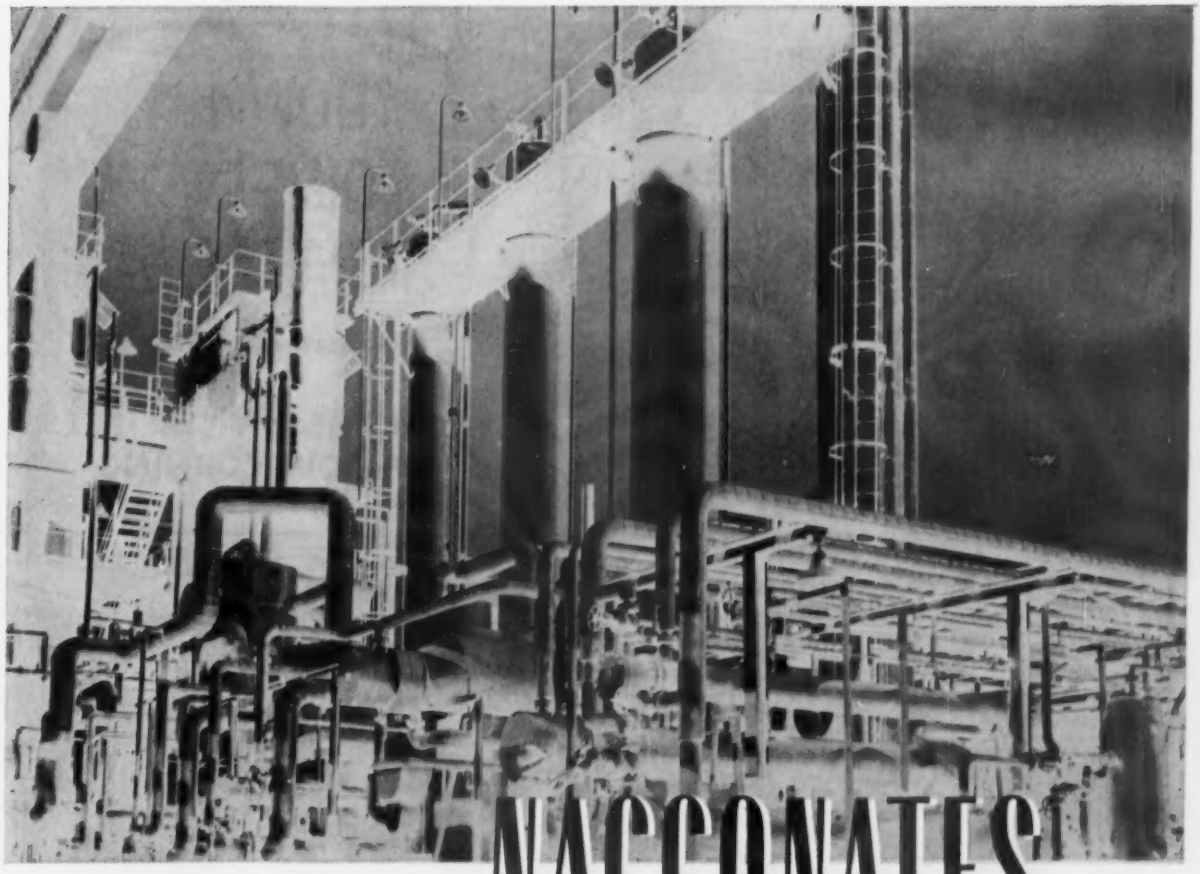

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## *for your present and potential urethane production*

Our multimillion-dollar plant at Moundsville, W. Va. is now producing NACCONATES in substantial commercial quantities for urethane makers. We are prepared to supply whatever quantity you need for development or full-scale production.

If you are doing research in the urethane field, we will be glad to share with you the product and application data developed in our Buffalo Research Laboratories. The coupon at the right is for your convenience.

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*Please mail me literature checked below:*

- ☐ Technical Bulletins I-17A to F on NACCONATES
- ☐ Application Data Sheet 41156—Flexible Foams
- ☐ Application Data Sheet 7956—Semi-rigid Foams
- ☐ Application Data Sheet 112356—Protective Coatings
- ☐ Interested in Literature only.
- ☐ Have representative call by appointment.

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TITLE _____

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CITY _____ STATE _____

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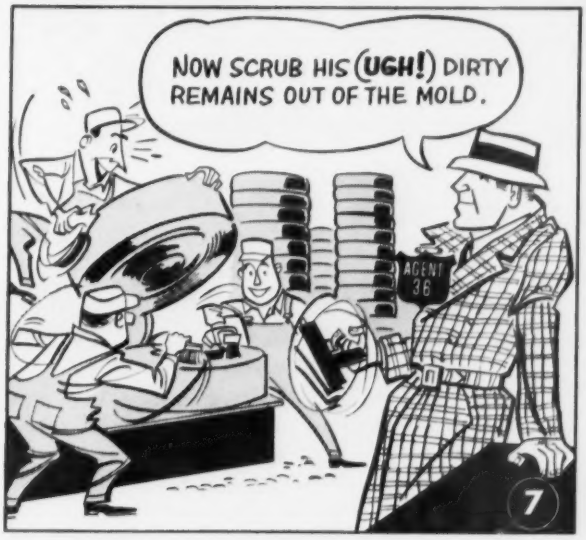
# AGENT 36
## SILICONE SQUAD

## HOW I SOLVED THE SCRAP CAPER

**FROM THE OFFICIAL FILES OF DOW CORNING**

GOO, YOU'RE THROUGH. YOU'VE PULLED YOUR LAST STICK UP!
OPEN THE MOLD RICHARD!
AGENT 36
BRRACK! YOU'LL NEVER GET ME GUM-SHOO!
5

NO, NO, PLEASE... NO, NOT DOW CORNING SILICONES... NO... OH NO!... ARGHH!
AGENT 36
TAKE THAT! AND THAT!
6


NOW SCRUB HIS (UGH!) DIRTY REMAINS OUT OF THE MOLD.
AGENT 36
7

THAT FINISHES STU GOO, AND YOUR SCRAP TROUBLES, TOO. YOUR MOLDS WILL NEVER GUNK UP WHEN THEY'RE LUBRICATED WITH DOW CORNING 36 EMULSION.
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K. Fresh Air Intake
L. Discharge Ducts and Air Distribution Grilles
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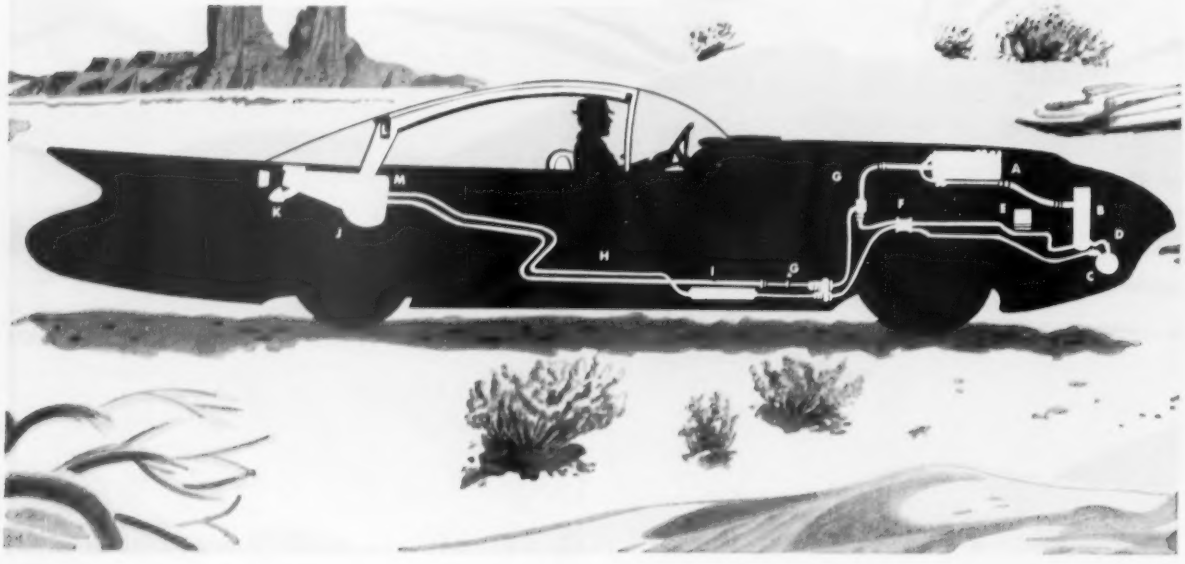


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Rubber Age

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# Compounding Rubbers for Resistance to Silicate-Ester Fluids

## *Part II: Nitrile, Vinyl Pyridine, Butyl and Acrylate Polymers*

***The description of research in the development of practical rubber compounds to be used in contact with silicate-ester type hydraulic fluids at 400° F. is concluded***

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THIS is the second of two papers on the compounding of rubbers for resistance to silicate-ester type hydraulic fluids at 400°F. Three fluids of this class have been included in the investigation: OS-45, MLO-8200, and 85/15 blend of MLO-8200 and Monoplex DOS. Hydraulic fluids of this type are needed for military aircraft operating at high speeds. Rubber compositions were sought which would have the following physical properties before and after immersion for 500 hours in these fluids at 400°F.:

| Physical Property | Before | After 500 Hours |
|---|---|---|
| Tensile strength, psi (min) | 1500 | 800 |
| Elongation, per cent (min) | 200 | 100 |
| Hardness, Shore A | 60—80 | 60—85 |
| Low-temperature flexibility, °F | —65 | —65 |
| Volume change | — | +5 to +30 |

In the previous paper, it was reported that compounding studies with Neoprene WRT extended its useful life for this application to 168 hours, after which time the polymer was considered unusable because of cracking. The present paper describes an evaluation and development program conducted with other polymers in an effort to obtain the desired physical properties, especially freedom from cracking.

Throughout this paper a number of proprietary materials are mentioned by name. However, there is no intent by the authors to imply or infer that comparable materials by other suppliers would not necessarily give similar results. It is recognized that some of these materials were evaluated under conditions far beyond their intended use. Therefore, in instances where poor results were obtained, this should not reflect on their quality or performance for other less demanding applications.

### Compounding Hycar 1014

Nitrile rubber was included in the evaluation of various polymers for this application because of the well-known oil resistance of this class of rubbers. The initial nitrile-rubber recipe chosen for probing the effects of several compounding variables was one that was developed for a high-nitrile rubber (Hycar 1001) in a similar program initiated to develop a rubber composi-

tion having resistance to a diester-type lubricant at 350°F*. The original composition was unique because magnesia was used as a reinforcing agent and gave better results than carbon black. Although a high-nitrile rubber would have given optimum high-temperature resistance, a low-nitrile polymer (Hycar 1014) was selected because of its better low-temperature flexibility. Recipe variations were tried in the choice and amounts of vulcanizing agents, fillers, and antioxidants.

**Vulcanizing Agents.** The results for the initial magnesia-filled Hycar 1014 recipe (A-334) are shown in Table I. The samples swelled much less than the 30 per cent allowed, indicating that the low-nitrile rubber had adequate oil resistance. This stock had a very low original tensile strength (670 psi), which declined to about one-half this value after immersion for 72 hours in oil at 400°F. After longer aging periods, the tensile strength increased, but this was associated with a serious loss in elongation and a tendency toward cracking in some samples. The changes in properties during aging indicate that chain scission reactions dominated the early aging period, but later cross-linking became a more dominant factor. This general trend has been found to be typical of all unsaturated polymers investigated.

Varying the ratios of stearic acid, sulfur, and tetramethylthiuram disulfide produced a decided improvement in the balance of original properties, but gains made in original properties did not persist after aging. It was concluded that only marginal gains could be expected by further studies of vulcanization agents.

**Fillers.** Several fillers were compared in an effort to upgrade the very low tensile strength of the oil-aged magnesia-filled stock. Table II shows that the silica fillers, Hi-Sil and Cab-O-Sil, appeared to give the best balance of properties. This is demonstrated in the results for Recipe A-385, filled with 60 phr (parts per hundred parts rubber) Hi-Sil, and for Recipe A-389, filled with 70 phr Cab-O-Sil. The compositions which contained Philblack A, Silene EF, Calcene NC, and Dixie Clay gave results inferior to those of Cab-O-Sil and Hi-Sil.

**Antioxidants.** Preliminary work with Hycar 1014 indicated that this material increased in hardness, cracked, and lost elongation during aging. Since these changes are often produced by oxidation, antioxidants were added to help maintain original properties. The results for several of the most effective antioxidants for nitrile rubber can be seen in Table III. These data show that even the most effective additive, selenium dioxide, gave only partial improvement. This additive considerably increased the original tensile strength, indicating possible action as a vulcanizing agent. In addition, the stocks containing small amounts of selenium dioxide showed less loss in elongation and increase in hardness than the control for stocks aged for 168 and 336 hours at 400°F. However, these gains were considered marginal compared to the improvement needed to meet the target properties of this research.

For short aging periods (72 hours), Agerite Resin D was very effective in retaining the elongation of the stock, but this benefit was lost as the aging period was extended. Neither mercaptobenzimidazole nor BLE were effective as antioxidants. Since the aging test was con-

TABLE I—THE EFFECTS OF VULCANIZING AGENTS ON THE AGING OF HYCAR 1014 COMPOUNDS

Base recipe

| Ingredients | Parts by weight |
|---|---|
| Hycar 1014 | 100 |
| ELC magnesia | 100 |
| Zinc oxide | 5 |
| Plasticizer SC | 10 |
| Vulcanizing agents | As shown |

Cure: 60 minutes at 310°F.

[a] Tetramethylthiuram disulfide.

| Recipe | Vulcanizing Agent, phr | | | Original Physical Properties | | | | Physical Properties After Aging in OS-45 at 400°F. | | | | Physical Properties After Aging in MLO-8200 at 400°F. | | | | | Physical Properties After Aging in 85/15 MLO 8200/DOS Blend at 400°F. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Stearic Acid | Sulfur | TMTD[a] | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Aging Time, hours | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking |
| A-334 (Control) | 1.5 | 0.5 | 0.25 | 670 | 760 | 50 | 72 | 190 | 110 | 58 | 20.0 | None | 470 | 130 | 65 | 7.3 | None | 390 | 160 | 56 | 19.2 | None |
| | | | | | | | 168 | 390 | 70 | 70 | 15.9 | None | 650 | 90 | 78 | 4.2 | None | 450 | 100 | 67 | 15.8 | None |
| A-343 | 1.5 | 0.5 | — | 450 | 510 | 49 | 72 | 210 | 100 | 60 | 18.4 | None | 510 | 120 | 70 | 6.3 | None | 390 | 130 | 61 | 17.4 | None |
| | | | | | | | 168 | 280 | 60 | 75 | 14.7 | None | 650 | 70 | 81 | 2.1 | None | 440 | 80 | 74 | 12.9 | None |

* Wright Air Development Center Technical Report 54-190, Part 1, April 1954, and Part 2, December 1954.

TABLE I (Continued)

| Recipe | Vulcanizing Agent, phr | | | Original Physical Properties | | | Physical Properties After Aging in OS-45 at 400°F. | | | | | Physical Properties After Aging in MLO-8200 at 400°F. | | | | | Physical Properties After Aging in 85/15 MLO 8200/DOS Blend at 400°F. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Stearic Acid | Sulfur | TMTD[a] | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Aging Time, hours | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking |
| A-344 | 1.5 | 0.5 | 0.5 | 1060 | 530 | 55 | 72 | 250 | 110 | 61 | 15.4 | None | 470 | 110 | 70 | 5.7 | None | 280 | 130 | 61 | 17.0 | None |
| | | | | | | | 168 | 300 | 80 | 74 | 13.6 | None | 610 | 70 | 81 | 1.8 | None | 440 | 80 | 74 | 11.4 | None |
| A-345 | 1.5 | 0.5 | 1.0 | 990 | 450 | 58 | 72 | 290 | 120 | 62 | 15.3 | None | 490 | 120 | 71 | 4.8 | None | 450 | 150 | 61 | 15.8 | None |
| | | | | | | | 168 | 360 | 80 | 76 | 11.4 | None | 710 | 80 | 82 | 1.0 | None | 430 | 80 | 75 | 10.9 | None |
| A-346 | 1.5 | — | 0.25 | (Undercured) | | | | | | | | | | | | | | | | | | |
| A-347 | 1.5 | 0.25 | 0.25 | 400 | 470 | 58 | 72 | 190 | 120 | 62 | 20.0 | None | 490 | 110 | 70 | 6.3 | None | 440 | 170 | 58 | 17.4 | None |
| | | | | | | | 168 | 340 | 80 | 75 | 14.3 | None | 580 | 70 | 81 | 3.3 | None | 410 | 70 | 74 | 13.0 | None |
| A-348 | 1.5 | 0.75 | 0.25 | 1050 | 510 | 65 | 72 | 410 | 100 | 64 | 17.8 | None | 570 | 100 | 72 | 5.4 | None | 440 | 120 | 62 | 16.6 | None |
| | | | | | | | 168 | 470 | 70 | 76 | 13.3 | Cracked | 570 | 70 | 82 | 3.9 | Cracked | 500 | 70 | 77 | 12.5 | Cracked |
| A-349 | 1.5 | 1.0 | 0.25 | 1270 | 510 | 67 | 72 | 300 | 80 | 65 | 15.9 | None | 440 | 90 | 70 | 5.1 | None | 370 | 100 | 63 | 15.9 | None |
| | | | | | | | 168 | 500 | 70 | 79 | 12.2 | Cracked | 840 | 60 | 87 | 1.9 | Cracked | 450 | 70 | 78 | 10.9 | None |
| A-350 | — | 0.5 | 0.25 | 910 | 450 | 68 | 72 | 410 | 100 | 65 | 17.9 | None | 570 | 100 | 73 | 5.9 | None | 660 | 150 | 63 | 17.7 | None |
| | | | | | | | 168 | 510 | 60 | 78 | 12.7 | Cracked | 780 | 70 | 85 | 2.4 | Cracked | 470 | 70 | 76 | 12.6 | Cracked |
| A-351 | 1.0 | 0.5 | 0.25 | 780 | 420 | 63 | 72 | 270 | 100 | 62 | 18.2 | None | 480 | 110 | 70 | 7.0 | None | 340 | 130 | 61 | 19.1 | None |
| | | | | | | | 168 | 410 | 60 | 77 | 13.6 | Cracked | 730 | 60 | 84 | 2.7 | Cracked | 510 | 80 | 74 | 13.4 | Cracked |
| A-352 | 2.0 | 0.5 | 0.25 | 850 | 430 | 63 | 72 | 310 | 100 | 60 | 17.0 | None | 580 | 110 | 70 | 6.6 | None | 330 | 110 | 65 | 16.8 | None |
| | | | | | | | 168 | 350 | 70 | 73 | 14.1 | Cracked | 630 | 70 | 81 | 3.2 | Cracked | 430 | 80 | 72 | 13.7 | None |

ducted in closed containers, no outside air could reach the samples. Thus, the hardening during aging, often attributed to a reaction between rubber and oxygen, takes place in an essentially air-free system. A small amount of oxygen, of course, may have been in the sample bottles before they were sealed. Even in the entire absence of oxygen, it is believed that the cross-linking reaction could have been produced by a free radical mechanism, with initiation produced by a combination of heat and impurities present in the rubber and/or hydraulic fluid.

Thus, nitrile rubber (Hycar 1014) was found to show very little promise for the application, since stocks of this type lost an excessive amount of elongation and were prone to cracking. Furthermore, the lowest brittle point obtained for stocks of this type was only about —55°F., which makes it doubtful that they possessed the necessary low-temperature flexibility for rubber components to be used in military aircraft hydraulic systems.

## Compounding Philprene VP-25

Philprene VP (a copolymer of butadiene and 2-methyl vinyl pyridine) is reported to have outstanding resistance to hot oils and excellent low-temperature properties. At present two copolymers of this type are available, Philprene VP-15 and Philprene VP-25, with the 15 and 25 referring to the percent of 2-methyl vinyl pyridine present. Preliminary work indicated that Philprene VP-15 swelled excessively in silicate-ester fluids at 400°F., so the effort was concentrated on Philprene VP-25. Variables investigated were the use of quaternizing agents and the effect of various fillers.

**Quaternizing Agents.** Quaternizing agents are claimed to help Philprene VP-25 retain its properties during aging. In this program, two such materials, benzal chloride and benzotrichloride, were investigated in stocks reinforced with Cab-O-Sil, Philblack A, and Silene EF. The data in Table IV show that quaternizing agents increased the tensile strength and elongation, and decreased the hardness of aged Cab-O-Sil filled stocks. Recipe VP-36, containing 5 phr of benzotrichloride, gave the best results of any Philprene VP-25 stock produced on this program.

In Tables V and VI are shown the effects of quaternizing agents in similar stocks filled with Philblack A and with Silene EF. Although quaternizing agents improved the tensile strength of these stocks after aging, the increase was accomplished at the expense of a considerable loss in elongation and an excessive increase in hardness, so that a poor over-all balance of properties resulted.

**Fillers.** The relative effects of Cab-O-Sil, Philblack A, and Silene EF on the hot-oil aging of Philprene VP-25 can be obtained by comparing the data in Tables IV through VI. Thus, in stocks with the same type and amount of quaternizing agent (such as with 5 phr of benzotrichloride or benzal chloride), Cab-O-Sil and Philblack A gave better results than did Silene EF. The Philprene VP-25 stocks were all low in physical properties, both before and after aging, and they had about the same deficiency in crack resistance as did the compositions based on nitrile rubber.

**Low-Temperature Properties.** One of the target properties of this project was flexibility at —65°F. Since

## TABLE II—THE EFFECTS OF FILLERS ON THE AGING OF HYCAR 1014 COMPOUNDS

Base Recipe

| Ingredients | Parts by Weight |
|---|---|
| Hycar 1014 | 100.0 |
| Filler | As shown |
| Zinc oxide | 5.0 |
| Stearic acid | 1.5 |
| Plasticizer SC | 10.0 |
| Sulfur | 0.5 |
| Tetramethylthiuram disulfide | 0.25 |

Cure: 60 minutes at 310°F.

| | Filler | | —Original Physical Properties— | | | | —Physical Properties After Aging in OS-45 at 400°F.— | | | | | —Physical Properties After Aging in MLO-8200 at 400°F.— | | | | | —Physical Properties After Aging in 85/15 MLO-8200/DOS Blend at 400°F.— | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Recipe | Type | Phr by Weight | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Aging Time, hours | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking |
| A-384 | ELC magnesia | 100 | 920 | 450 | 56 | 72 | 250 | 70 | 67 | 15.7 | Cracked | 510 | 80 | 76 | 4.6 | None | 260 | 70 | 70 | 13.9 | None |
| | | | | | | 168 | 460 | 50 | 81 | 10.9 | Cracked | 1120 | 50 | 91 | —0.5 | Cracked | 590 | 60 | 80 | 9.3 | Cracked |
| | | | | | | 336 | 1780 | 20 | 98 | 8.1 | Cracked | 2610 | 10 | 100 | —2.4 | Cracked | 2490 | 20 | 99 | 3.4 | Cracked |
| A-335 | Philblack A | 50 | 1100 | 350 | 58 | 72 | 320 | 70 | 67 | 13.5 | Cracked | 440 | 70 | 76 | 0.8 | Cracked | 380 | 80 | 67 | 12.6 | None |
| | | | | | | 168 | 350 | 50 | 71 | 13.1 | Cracked | 770 | 60 | 81 | 0.2 | Cracked | 430 | 70 | 72 | 10.4 | Cracked |
| A-336 | Philblack A | 100 | 910 | 170 | 78 | 72 | 560 | 50 | 84 | 12.2 | Cracked | 810 | 40 | 92 | 1.0 | Cracked | 610 | 50 | 83 | 10.6 | Cracked |
| | | | | | | 168 | 570 | 30 | 88 | 14.9 | Cracked | 1400 | 30 | 94 | —0.2 | Cracked | 830 | 50 | 86 | 9.7 | Cracked |
| A-337 | Silene EF | 50 | 680 | 620 | 52 | 72 | 110 | 100 | 57 | 18.1 | None | 200 | 120 | 61 | 8.2 | None | 110 | 130 | 54 | 15.6 | None |
| | | | | | | 168 | 240 | 80 | 66 | 14.4 | Cracked | 390 | 80 | 72 | 2.4 | Cracked | 220 | 90 | 64 | 12.8 | Cracked |
| A-338 | Silene EF | 100 | 830 | 410 | 73 | 72 | 230 | 80 | 71 | 19.6 | None | 420 | 100 | 77 | 8.6 | None | 330 | 100 | 70 | 18.4 | None |
| | | | | | | 168 | 330 | 70 | 77 | 17.6 | Cracked | 500 | 70 | 83 | 7.7 | Cracked | 440 | 70 | 80 | 14.2 | Cracked |
| A-390 | Calcene NC | 120 | 790 | 660 | 50 | 72 | 80 | 60 | 63 | 9.8 | Cracked | 200 | 50 | 75 | 0.5 | Cracked | 80 | 70 | 67 | 10.3 | Cracked |
| | | | | | | 168 | 170 | 60 | 70 | 8.6 | Cracked | 300 | 40 | 81 | —1.8 | Cracked | 130 | 50 | 71 | 7.3 | Cracked |
| A-391 | Dixie clay | 120 | 390 | 460 | 54 | 72 | 510 | 60 | 71 | 11.7 | Edge crack'g | 1190 | 60 | 82 | 0.9 | Edge crack'g | 590 | 60 | 76 | 11.1 | None |
| | | | | | | 168 | 450 | 40 | 78 | 10.3 | Cracked | 1230 | 40 | 87 | —1.2 | Cracked | 630 | 40 | 80 | 8.2 | Cracked |
| A-339 | Hi-Sil | 50 | 790 | 710 | 56 | 72 | 420 | 110 | 62 | 17.6 | None | 590 | 120 | 72 | 4.8 | None | 460 | 130 | 65 | 15.7 | None |
| | | | | | | 168 | 470 | 70 | 78 | 13.4 | Cracked | 830 | 80 | 86 | 0.9 | Cracked | 640 | 90 | 78 | 11.3 | None |
| | | | | | | 336 | — | — | — | — | — | — | — | — | — | — | 1090 | 70 | 84 | 7.8 | Cracked |
| A-385 | Hi-Sil | 60 | 800 | 640 | 56 | 72 | 600 | 90 | 77 | 15.6 | None | 770 | 80 | 86 | 4.6 | Cracked | 580 | 90 | 77 | 14.3 | None |
| | | | | | | 168 | 940 | 50 | 89 | 12.4 | Cracked | 1490 | 50 | 93 | 1.7 | Cracked | 1080 | 60 | 89 | 9.5 | Cracked |
| | | | | | | 336 | 1670 | 40 | 93 | 11.4 | Cracked | 3100 | 20 | 98 | —0.5 | Cracked | 2130 | 40 | 95 | 5.9 | Cracked |
| A-386 | Hi-Sil | 70 | 830 | 470 | 76 | 72 | 630 | 60 | 83 | 16.5 | Cracked | 1090 | 80 | 90 | 5.8 | None | 810 | 70 | 85 | 14.3 | None |
| | | | | | | 168 | 1190 | 40 | 93 | 12.4 | Cracked | 1930 | 50 | 96 | 0.6 | Cracked | 870 | 60 | 90 | 10.3 | Cracked |
| A-387 | Hi-Sil | 80 | 730 | 520 | 80 | 72 | 580 | 60 | 87 | 17.0 | Cracked | 780 | 60 | 93 | 7.1 | Cracked | 710 | 70 | 87 | 15.3 | Cracked |
| | | | | | | 168 | 870 | 30 | 93 | 14.4 | Cracked | 1360 | 40 | 97 | 3.8 | Cracked | 830 | 40 | 92 | 12.4 | Cracked |
| A-340 | Hi-Sil | 100 | 1220 | 470 | 91 | 72 | 800 | 70 | 93 | 15.5 | Cracked | 1440 | 90 | 96 | 6.1 | Cracked | 1110 | 110 | 93 | 15.7 | None |
| | | | | | | 168 | 1160 | 40 | 97 | 14.4 | Cracked | 1910 | 60 | 98 | 4.7 | Cracked | 1390 | 60 | 96 | 13.8 | Cracked |
| A-341 | Cab-O-Sil | 50 | 330 | 680 | 63 | 72 | 210 | 80 | 77 | 16.0 | Cracked | 520 | 110 | 78 | 4.9 | None | 510 | 160 | 67 | 18.8 | None |
| | | | | | | 168 | 370 | 80 | 77 | 18.3 | None | 870 | 80 | 87 | 2.4 | Cracked | 490 | 90 | 80 | 14.4 | None |
| | | | | | | 336 | — | — | — | — | — | — | — | — | — | — | 830 | 60 | 87 | 9.5 | Cracked |
| A-388 | Cab-O-Sil | 60 | 290 | 310 | 68 | 72 | 550 | 110 | 76 | 17.4 | None | 850 | 90 | 86 | 3.9 | None | 530 | 100 | 76 | 16.5 | None |
| | | | | | | 168 | 740 | 70 | 85 | 15.8 | Cracked | 1540 | 50 | 94 | 1.3 | Cracked | 790 | 70 | 85 | 13.6 | Cracked |
| A-389 | Cab-O-Sil | 70 | 930 | 560 | 81 | 72 | 730 | 120 | 84 | 16.8 | None | 1030 | 90 | 92 | 3.8 | Cracked | 700 | 110 | 86 | 16.1 | None |
| | | | | | | 168 | 1030 | 60 | 90 | 15.1 | Cracked | 1920 | 60 | 96 | 1.7 | Cracked | 1050 | 70 | 91 | 13.4 | Cracked |
| A-342 | Cab-O-Sil | 75 | 710 | 650 | 86 | 72 | 790 | 140 | 85 | 17.5 | None | 930 | 100 | 93 | 5.2 | None | 790 | 130 | 86 | 16.7 | None |
| | | | | | | 168 | 750 | 90 | 90 | 16.6 | None | 1590 | 70 | 97 | 3.0 | Cracked | 750 | 80 | 90 | 15.3 | None |

## TABLE III—THE EFFECTS OF ANTIOXIDANTS ON THE AGING OF HYCAR 1014 COMPOUNDS

Base recipe

| Ingredients | Parts by Weight |
|---|---|
| Hycar 1014 | 100.0 |
| ELC magnesia | 100.0 |
| Zinc oxide | 5.0 |
| Stearic acid | 1.5 |
| Antioxidant | As shown |
| Plasticizer SC | 10.0 |
| Sulfur | 0.5 |
| Tetramethylthiuram disulfide | 0.25 |

Cure: 60 minutes at 310°F.

| | Antioxidant | | Original Physical Properties | | | Physical Properties After Aging in OS-45 at 400°F. | | | | | | Physical Properties After Aging in MLO-8200 at 400°F. | | | | | | Physical Properties After Aging in 85/15 MLO-8200/DOS Blend at 400°F. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Recipe | Type | Phr by Weight | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Aging Time, hours | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking |
| A-384 | None | — | 920 | 450 | 56 | 72 | 250 | 70 | 67 | 15.7 | Cracked | 510 | 80 | 76 | 4.6 | None | 260 | 70 | 70 | 13.9 | None |
| | | | | | | 168 | 460 | 50 | 81 | 10.9 | Cracked | 1120 | 50 | 91 | —0.5 | Cracked | 590 | 60 | 80 | 9.3 | Cracked |
| | | | | | | 336 | 1780 | 20 | 98 | 8.1 | Cracked | 2610 | 10 | 100 | —2.4 | Cracked | 2490 | 20 | 99 | 3.4 | Cracked |
| A-360 | AgeRite Resin D | 1 | 930 | 340 | 55 | 72 | 350 | 110 | 62 | 15.5 | None | 550 | 110 | 72 | 6.2 | None | 470 | 120 | 63 | 16.2 | None |
| | | | | | | 168 | 410 | 70 | 75 | 13.4 | Cracked | 740 | 70 | 82 | 2.6 | Cracked | 490 | 70 | 74 | 11.9 | Cracked |
| | | | | | | 336 | 2410 | 30 | 98 | 7.1 | Cracked | 4220 | 10 | 99 | —2.7 | Cracked | 3130 | 20 | 100 | 2.8 | Cracked |
| A-361 | AgeRite Resin D | 5 | 570 | 480 | 51 | 72 | 190 | 140 | 59 | 16.5 | None | 500 | 130 | 70 | 4.5 | None | 390 | 130 | 61 | 15.1 | None |
| | | | | | | 168 | 410 | 80 | 73 | 10.4 | None | 660 | 80 | 80 | 0.9 | Cracked | 440 | 80 | 73 | 10.9 | None |
| | | | | | | 336 | 2170 | 20 | 98 | 6.2 | Cracked | 4130 | 10 | 99 | —4.7 | Cracked | 2630 | 20 | 100 | 2.5 | Cracked |
| A-375 | AgeRite Resin D | 10 | 560 | 640 | 48 | 72 | 180 | 120 | 62 | 12.0 | None | 490 | 100 | 72 | —0.2 | None | 300 | 100 | 66 | 9.6 | None |
| | | | | | | 168 | 210 | 90 | 67 | 11.6 | None | 410 | 100 | 75 | 1.2 | None | 170 | 100 | 65 | 9.8 | None |
| | | | | | | 336 | 1830 | 30 | 98 | 5.1 | Cracked | 3790 | 10 | 100 | —6.9 | Cracked | 2270 | 20 | 100 | —1.3 | Cracked |
| A-376 | AgeRite Resin D | 20 | 490 | 500 | 41 | 72 | 230 | 110 | 62 | 7.1 | None | 530 | 130 | 72 | —3.8 | None | 340 | 140 | 61 | 6.4 | None |
| | | | | | | 168 | 250 | 110 | 64 | 7.6 | None | 460 | 110 | 74 | —2.4 | None | 270 | 100 | 67 | 4.8 | None |
| | | | | | | 336 | 1870 | 30 | 99 | 0.6 | Cracked | 3640 | 10 | 100 | —10.2 | Cracked | 2470 | 20 | 99 | —4.6 | Cracked |
| A-362 | BLE | 1 | 630 | 530 | 54 | 72 | 250 | 100 | 60 | 17.6 | None | 430 | 100 | 70 | 4.8 | None | 300 | 120 | 61 | 17.5 | None |
| | | | | | | 168 | 330 | 60 | 73 | 14.0 | Cracked | 570 | 70 | 80 | 2.6 | Cracked | 290 | 70 | 72 | 13.4 | Cracked |
| | | | | | | 336 | 2670 | 20 | 96 | 7.0 | Cracked | 4220 | 10 | 100+ | —2.9 | Cracked | 2250 | 20 | 98 | 4.1 | Cracked |
| A-363 | BLE | 5 | 580 | 310 | 53 | 72 | 350 | 130 | 59 | 16.4 | None | 470 | 110 | 68 | 4.4 | None | 330 | 120 | 61 | 15.6 | None |
| | | | | | | 168 | 290 | 70 | 72 | 12.2 | Cracked | 530 | 70 | 77 | 2.5 | Cracked | 420 | 80 | 71 | 11.8 | Cracked |
| | | | | | | 336 | 1210 | 50 | 93 | 8.0 | Cracked | 4100 | 10 | 100 | —4.3 | Cracked | 3010 | 20 | 99 | 2.5 | Cracked |
| A-364 | Mercaptobenzimidazole | 1 | 540 | 370 | 53 | 72 | 240 | 120 | 58 | 18.3 | None | 410 | 100 | 70 | 5.8 | None | 370 | 130 | 58 | 18.0 | None |
| | | | | | | 168 | 330 | 70 | 72 | 14.2 | Cracked | 660 | 70 | 80 | 3.5 | Cracked | 290 | 80 | 70 | 15.0 | Cracked |
| A-365 | Mercaptobenzimidazole | 5 | 900 | 510 | 56 | 72 | 400 | 120 | 62 | 16.6 | None | 470 | 110 | 75 | 4.9 | None | 250 | 120 | 66 | 14.8 | None |
| | | | | | | 168 | 410 | 70 | 75 | 11.6 | Cracked | 570 | 70 | 83 | 2.4 | Cracked | 500 | 70 | 76 | 11.5 | Cracked |
| | | | | | | 336 | 2150 | 20 | 100 | 6.9 | Cracked | 3750 | 10 | 100 | —2.5 | Cracked | 2050 | 20 | 100 | 4.6 | Cracked |
| A-366 | Selenium dioxide | 1 | 910 | 430 | 58 | 72 | 270 | 100 | 62 | 16.6 | None | 390 | 90 | 71 | 5.6 | None | 280 | 110 | 66 | 16.7 | None |
| | | | | | | 168 | 380 | 70 | 73 | 13.6 | Cracked | 610 | 70 | 84 | 2.6 | Cracked | 410 | 70 | 72 | 12.9 | Cracked |
| | | | | | | 336 | 530 | 60 | 84 | 10.9 | Cracked | 1130 | 50 | 94 | 0.4 | Cracked | 860 | 60 | 87 | 8.0 | Cracked |
| A-367 | Selenium dioxide | 5 | 1430 | 340 | 68 | 72 | 250 | 100 | 65 | 16.9 | None | 440 | 90 | 76 | 5.9 | None | 350 | 100 | 70 | 16.1 | None |
| | | | | | | 168 | 410 | 60 | 77 | 12.9 | Cracked | 750 | 60 | 87 | 2.6 | Cracked | 270 | 60 | 77 | 12.2 | Cracked |
| | | | | | | 336 | 710 | 50 | 87 | 10.5 | Cracked | 810 | 40 | 91 | 1.7 | Cracked | 490 | 60 | 85 | 10.8 | Cracked |
| A-380 | Selenium dioxide | 10 | 830 | 160 | 76 | 72 | 470 | 60 | 83 | 8.7 | Cracked | 710 | 50 | 90 | 1.9 | Cracked | 400 | 60 | 83 | 9.0 | None |
| | | | | | | 168 | 500 | 40 | 87 | 6.9 | Cracked | 850 | 40 | 92 | 1.0 | Cracked | 500 | 50 | 87 | 7.0 | Cracked |
| A-381 | Selenium dioxide | 20 | 1070 | 120 | 81 | 72 | 520 | 60 | 84 | 8.4 | Cracked | 790 | 60 | 90 | 1.9 | Cracked | 590 | 50 | 88 | 7.3 | Cracked |
| | | | | | | 168 | 510 | 40 | 89 | 5.8 | Cracked | 810 | 40 | 94 | 1.0 | Cracked | 600 | 50 | 87 | 5.7 | Cracked |

excellent low-temperature properties have been claimed for Philprene VP-25, both brittle-point and temperature-retraction tests were made on this polymer. The data presented in Tables IV through VI show that brittle points of <–94, <–71, and <–45°F. were obtained for stocks filled with Philblack A, Cab-O-Sil, and Silene EF, respectively. These data show that the choice of filler material has a considerable effect on the brittle point obtained with Philprene VP-25.

For stocks going into gaskets or seals, the temperature-retraction (TR) data are probably more significant than the brittle points. In the TR test, the TR-10 value was selected as most indicative of low-temperature performance, since this is the temperature at which a rubber sample is just starting to regain rubberlike properties after being frozen in a stretched position.

Data in Table VII show a TR-10 value for the unplasticized Cab-O-Sil filled stock of –47°C. (–52.6°F.). This is exceeded only by plasticized Neoprene WRT and Acrylon BA-12 stocks having TR-10 values of –50°C. (–58°F.) and –48°C. (–54.4°F.). The use of plasticizers in rubber compositions that are to be immersed in fluids which will swell the rubber usually introduces the possibility that the plasticizer will be replaced by a greater or smaller amount of fluid, depending on the original amount of plasticizer and the amount of rubber swell. This implies that rubber may have better or poorer low-temperature properties after immersion in a fluid than before immersion. Comparisons between rubbers that have different swelling characteristics and may or may not contain plasticizers, therefore, should be viewed with some caution. However, in general, the low-temperature properties of Philprene VP-25 appear quite favorable.

## Compounding Hycar 1014 and Philprene VP-25 Blends

Blends of Philprene VP-25 and Hycar 1014 were investigated to determine whether Philprene VP-25 would enhance the performance of Hycar 1014. Since Philprene VP-25 has a very low brittle point, it was hoped that it might serve as a low-temperature plasticizer for Hycar 1014. As a vulcanizable polymer, Philprene VP-25 was not expected to degrade rubber physical properties in the manner usually associated with extractable plasticizers, such as Plasticizer SC.

Several combinations of these polymers were tried, with results shown in Table VIII. Recipe A-333 is for an unplasticized Hycar 1014 stock, whereas Recipe A-334 shows the effect of adding Plasticizer SC. Recipes A-353 to A-355 are for blends of Philprene VP-25 with Hycar 1014. These limited data indicated no advantage for the blending of the two rubbers. The physical properties, both before and after aging, appear to be poorer for the blends than for the Hycar 1014 alone. Somewhat better results might have been produced by more extensive compounding studies, such as by incorporating a quaternizing agent to obtain a better cure of the Philprene VP-25 in this combination, but the initial results did not appear to justify this effort.

## Compounding Miscellaneous Polymers

Very limited work was done with Philprene VP-A (a terpolymer of butadiene, vinyl pyridine, and acryloni-

TABLE IV—THE EFFECTS OF QUATERNIZING AGENTS ON THE AGING OF PHILPRENE VP-25 COMPOUNDS REINFORCED WITH CAB-O-SIL

Base recipe

| Ingredients | Parts by Weight |
|---|---|
| Philprene VP-25 | 100.0 |
| Cab-O-Sil | 40.0 |
| Quaternizing agent | As shown |
| Zinc oxide | 3.0 |

| Ingredients | Parts by Weight |
|---|---|
| Stearic acid | 1.5 |
| Sulfur | 1.5 |
| Benzothiazyl disulfide | 1.5 |
| Cure: 30 minutes at 310°F. | |

| Recipe | Quaternizing Agent Type | Quaternizing Agent Phr by Weight | Original Physical Properties: Tensile Strength, psi | Original Physical Properties: Elongation, % | Original Physical Properties: Hardness, Shore A | Original Physical Properties: Brittle Point, °F | Aging Time, hours | Physical Properties After Aging in OS-45 at 400°F.: Tensile Strength, psi | Physical Properties After Aging in OS-45 at 400°F.: Elongation, % | Physical Properties After Aging in OS-45 at 400°F.: Hardness, Shore A | Swell, % | Cracking |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VP-32 | None | — | 1960 | 250 | 70 | — | 72 | 170 | 90 | 56 | 42.6 | Cracked |
| | | | | | | | 168 | 170 | 60 | 64 | 28.2 | Cracked |
| VP-33 | Benzal chloride | 2 | 1990 | 260 | 69 | — | 72 | 190 | 80 | 58 | 38.6 | Cracked |
| | | | | | | | 168 | 190 | 70 | 64 | 32.1 | Cracked |
| VP-34 | Benzal chloride | 5 | 2880 | 290 | 72 | <—71 | 72 | 510 | 90 | 67 | 30.4 | None |
| | | | | | | | 168 | 600 | 80 | 73 | 26.4 | Cracked |
| | | | | | | | 336 | 590 | 50 | 81 | 20.2 | Cracked |
| VP-35 | Benzotri-chloride | 2 | 2560 | 260 | 72 | — | 72 | 470 | 90 | 65 | 32.9 | None |
| | | | | | | | 168 | 490 | 60 | 71 | 25.8 | Cracked |
| VP-36 | Benzotri-chloride | 5 | 3320 | 300 | 77 | <—71 | 72 | 460 | 100 | 67 | 28.3 | None |
| | | | | | | | 168 | 470 | 50 | 71 | 25.5 | None |
| | | | | | | | 336 | 590 | 70 | 76 | 20.6 | Cracked |

| Recipe | Physical Properties After Aging in MLO-8200 at 400°F.: Tensile Strength, psi | Physical Properties After Aging in MLO-8200 at 400°F.: Elongation, % | Physical Properties After Aging in MLO-8200 at 400°F.: Hardness, Shore A | Swell, % | Cracking |
|---|---|---|---|---|---|
| VP-32 | 250 | 70 | 67 | 16.7 | Cracked |
| | 410 | 50 | 77 | 9.0 | Cracked |
| VP-33 | 300 | 80 | 68 | 17.1 | Cracked |
| | 440 | 60 | 77 | 10.6 | Cracked |
| VP-34 | 860 | 100 | 76 | 13.1 | None |
| | 880 | 60 | 86 | 8.4 | Cracked |
| | 1630 | 40 | 92 | 4.5 | Cracked |
| VP-35 | 570 | 80 | 75 | 13.0 | Cracked |
| | 780 | 60 | 82 | 9.2 | Cracked |
| VP-36 | 870 | 130 | 75 | 12.5 | None |
| | 1010 | 80 | 84 | 7.8 | Cracked |
| | 1330 | 70 | 85 | 6.4 | Cracked |

| Recipe | Physical Properties After Aging in 85/15 MLO-8200/DOS Blend at 400°F.: Tensile Strength, psi | Physical Properties After Aging in 85/15 MLO-8200/DOS Blend at 400°F.: Elongation, % | Physical Properties After Aging in 85/15 MLO-8200/DOS Blend at 400°F.: Hardness, Shore A | Swell, % | Cracking |
|---|---|---|---|---|---|
| VP-32 | 160 | 80 | 59 | 32.7 | Cracked |
| | 130 | 60 | 67 | 23.7 | Cracked |
| VP-33 | 210 | 80 | 61 | 29.8 | None |
| | 210 | 60 | 72 | 21.2 | Cracked |
| VP-34 | 600 | 100 | 70 | 25.6 | None |
| | 470 | 60 | 78 | 19.4 | Cracked |
| | 1020 | 40 | 92 | 4.5 | Cracked |
| VP-35 | 490 | 90 | 69 | 25.7 | None |
| | 410 | 60 | 74 | 21.0 | Cracked |
| VP-36 | 750 | 130 | 70 | 22.8 | None |
| | 750 | 90 | 76 | 18.6 | None |
| | 1150 | 80 | 81 | 13.4 | Cracked |

## TABLE V—THE EFFECTS OF QUATERNIZING AGENTS ON THE AGING OF PHILPRENE VP-25 COMPOUNDS REINFORCED WITH PHILBLACK A

Base recipe

| Ingredients | Parts by Weight |
|---|---|
| Philprene VP-25 | 100.0 |
| Philblack A | 40.0 |
| Quaternizing agent | As shown |
| Zinc oxide | 3.0 |
| Stearic acid | 1.5 |
| Sulfur | 1.5 |
| Benzothiazyl disulfide | 1.5 |

Cure: 30 minutes at 310°F.

| | Quaternizing Agent | | Original Physical Properties | | | | | Physical Properties After Aging in OS-45 at 400°F | | | | | Physical Properties After Aging in MLO-8200 at 400°F. | | | | | Physical Properties After Aging in 85/15 MLO-8200/DOS Blend at 400°F. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Recipe | Type | Phr by Weight | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Brittle Point, F | Aging Time, hours | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking |
| VP-5 | None | — | 3280 | 400 | 69 | <—94 | 72 | 40 | 80 | 48 | 37.2 | None | 390 | 80 | 58 | 14.7 | None | 200 | 110 | 51 | 35.2 | None |
| | | | | | | | 168 | 20 | 60 | 58 | 30.2 | None | 290 | 60 | 68 | 9.6 | Cracked | 170 | 70 | 59 | 26.3 | Cracked |
| VP-28 | Benzal chloride | 2 | 2200 | 290 | 63 | — | 72 | 230 | 100 | 56 | 41.2 | None | 210 | 60 | 68 | 14.7 | Cracked | 230 | 70 | 62 | 29.4 | None |
| | | | | | | | 168 | 180 | 60 | 72 | 23.0 | Cracked | 660 | 40 | 84 | 4.6 | Cracked | 230 | 50 | 75 | 15.4 | Cracked |
| VP-29 | Benzal chloride | 5 | 2560 | 270 | 67 | — | 72 | 420 | 70 | 67 | 26.6 | Cracked | 760 | 70 | 76 | 9.8 | Cracked | 490 | 70 | 69 | 21.9 | Cracked |
| | | | | | | | 168 | 790 | 50 | 82 | 15.8 | Cracked | 1320 | 30 | 94 | 0.8 | Cracked | 820 | 50 | 84 | 10.2 | Cracked |
| VP-4 | Benzal chloride | 10 | 3730 | 370 | 73 | — | 72 | 460 | 60 | 74 | 21.3 | Cracked | 840 | 70 | 81 | 8.6 | Cracked | 770 | 80 | 76 | 18.7 | None |
| | | | | | | | 168 | 520 | 40 | 85 | 14.5 | Cracked | 2050 | 40 | 95 | 1.0 | Cracked | 1260 | 50 | 88 | 8.7 | Cracked |
| VP-6 | Benzal chloride | 20 | 3110 | 330 | 74 | — | 72 | 630 | 40 | 86 | 16.5 | Cracked | 1510 | 30 | 97 | 1.6 | Cracked | 1260 | 40 | 93 | 9.9 | Cracked |
| | | | | | | | 168 | 1270 | 40 | 95 | 9.7 | Cracked | 3590 | 10 | 100+ | —6.6 | Cracked | 2440 | 30 | 98 | —0.8 | Cracked |
| VP-30 | Benzotri-chloride | 2 | 2790 | 280 | 67 | — | 72 | 270 | 80 | 62 | 32.4 | Cracked | 450 | 70 | 72 | 11.2 | Cracked | 280 | 80 | 63 | 27.5 | Cracked |
| | | | | | | | 168 | 10 | 10 | 79 | 18.3 | Cracked | 950 | 40 | 87 | 3.5 | Cracked | 510 | 50 | 80 | 11.6 | Cracked |
| VP-31 | Benzotri-chloride | 5 | 3340 | 260 | 72 | — | 72 | 450 | 70 | 65 | 29.0 | None | 810 | 80 | 76 | 10.0 | Cracked | 500 | 90 | 64 | 24.2 | None |
| | | | | | | | 168 | 450 | 50 | 76 | 17.5 | Cracked | 1070 | 50 | 88 | 1.9 | Cracked | 730 | 60 | 80 | 11.8 | Cracked |
| VP-10 | Benzotri-chloride | 10 | 3680 | 310 | 75 | — | 72 | 590 | 70 | 76 | 21.7 | Cracked | 1390 | 50 | 92 | 4.7 | Cracked | 1000 | 60 | 84 | 13.5 | Cracked |
| | | | | | | | 168 | 1000 | 40 | 93 | 10.9 | Cracked | 3610 | 30 | 100+ | —3.5 | Cracked | 1890 | 40 | 95 | 4.7 | Cracked |
| VP-11 | Benzotri-chloride | 20 | 3510 | 330 | 73 | — | 72 | 870 | 30 | 93 | 11.7 | Cracked | 2210 | 20 | 100 | —2.6 | Cracked | 1890 | 30 | 98 | 3.5 | Cracked |
| | | | | | | | 168 | 1800 | 20 | 100 | 2.9 | Cracked | 4330 | 10 | 100+ | —6.2 | Cracked | 3260 | 10 | 100+ | —4.9 | Cracked |

## TABLE VI—THE EFFECTS OF QUATERNIZING AGENTS ON THE AGING OF PHILPRENE VP-25 COMPOUNDS REINFORCED WITH SILENE EF

Base recipe

| Ingredients | Parts by Weight: VP-7, -17, -18, -22, -23, -24 | Parts by Weight: VP-19, -20, -21, -25, -26, -27 |
|---|---|---|
| Philprene VP-25 | 100.0 | 100.0 |
| Silene EF | 46.6 | 46.6 |
| Quaternizing agent | As shown | As shown |
| Zinc oxide | 3.0 | 5.0 |
| Stearic acid | 1.5 | 1.5 |
| Sulfur | 1.5 | 0.25 |
| Benzothiazyl disulfide | 1.5 | 3.0 |
| Tetramethylthiuram disulfide | — | 2.0 |

Cure: 30 minutes at 310°F.

| | Quaternizing Agent | | Original Physical Properties | | | | | Physical Properties After Aging in OS-45 at 400°F. | | | | | Physical Properties After Aging in MLO-8200 at 400°F. | | | | | Physical Properties After Aging in 85/15 MLO-8200/DOS Blend at 400°F. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Recipe | Type | Phr by Weight | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Brittle Point, F | Aging Time, hours | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking |
| VP-7 | None | — | 980 | 580 | 62 | —45 | 72 | 0 | 150 | 33 | 56.4 | None | 30 | 120 | 50 | 25.7 | None | 10 | 130 | 41 | 45.3 | None |
| | | | | | | | 168 | 50 | 120 | 42 | 46.1 | None | 150 | 90 | 61 | 19.2 | None | 0 | 80 | 51 | 35.4 | None |
| VP-17 | Benzal chloride | 5 | 1570 | 630 | 61 | — | 72 | 10 | 110 | 43 | 54.0 | None | 110 | 90 | 57 | 21.1 | None | 10 | 90 | 47 | 42.1 | None |
| | | | | | | | 168 | 10 | 90 | 43 | 46.9 | None | 70 | 50 | 68 | 15.5 | Cracked | 10 | 70 | 59 | 31.6 | Cracked |
| VP-18 | Benzal chloride | 10 | 1710 | 590 | 65 | — | 72 | 10 | 110 | 53 | 44.2 | None | 230 | 90 | 64 | 18.7 | None | 80 | 90 | 56 | 35.3 | None |
| | | | | | | | 168 | 30 | 80 | 55 | 38.5 | None | 260 | 50 | 76 | 12.3 | Cracked | 110 | 60 | 65 | 28.4 | Cracked |
| VP-22 | Benzotri-chloride | 2 | 970 | 530 | 60 | — | 72 | 0 | 100 | 44 | 52.2 | None | 90 | 80 | 61 | 20.1 | Cracked | 30 | 90 | 49 | 36.6 | Cracked |
| | | | | | | | 168 | 20 | 100 | 49 | 47.1 | None | 190 | 60 | 68 | 15.9 | Cracked | 30 | 70 | 57 | 33.6 | Cracked |
| VP-23 | Benzotri-chloride | 5 | 1260 | 520 | 66 | — | 72 | 30 | 80 | 53 | 41.7 | Cracked | 100 | 40 | 71 | 16.2 | Cracked | 50 | 70 | 57 | 32.6 | Cracked |
| | | | | | | | 168 | 20 | 70 | 57 | 37.7 | None | 180 | 60 | 70 | 15.7 | Cracked | 70 | 70 | 62 | 29.5 | Cracked |
| VP-24 | Benzotri-chloride | 10 | 1680 | 460 | 67 | — | 72 | 50 | 80 | 56 | 35.9 | Cracked | 370 | 80 | 70 | 14.4 | Cracked | 200 | 80 | 63 | 25.9 | Cracked |
| | | | | | | | 168 | 110 | 70 | 61 | 32.0 | Cracked | 430 | 80 | 72 | 10.9 | Cracked | 210 | 70 | 67 | 22.6 | Cracked |
| VP-19 | None | — | 510 | 410 | 59 | — | 72 | 0 | 220 | 26 | 83.6 | None | 20 | 150 | 45 | 30.5 | None | 10 | 150 | 35 | 54.2 | None |
| | | | | | | | 168 | 10 | 130 | 36 | 56.9 | None | 80 | 90 | 55 | 23.6 | None | 20 | 100 | 45 | 42.8 | None |
| VP-20 | Benzal chloride | 5 | 1680 | 660 | 62 | — | 72 | 0 | 170 | 32 | 68.3 | None | 80 | 100 | 55 | 27.9 | None | 10 | 100 | 44 | 47.6 | None |
| | | | | | | | 168 | 10 | 120 | 41 | 59.0 | None | 190 | 70 | 70 | 17.7 | Cracked | 30 | 70 | 58 | 35.0 | Cracked |
| VP-21 | Benzal chloride | 10 | 1660 | 530 | 67 | — | 72 | 170 | 150 | 45 | 49.2 | None | 230 | 110 | 61 | 20.5 | None | 110 | 100 | 50 | 37.2 | None |
| | | | | | | | 168 | 80 | 100 | 51 | 45.0 | None | 410 | 60 | 74 | 12.7 | Cracked | 210 | 70 | 65 | 26.6 | Cracked |
| VP-25 | Benzotri-chloride | 2 | 660 | 350 | 63 | — | 72 | 10 | 130 | 41 | 56.0 | None | 120 | 100 | 56 | 22.2 | None | 20 | 90 | 52 | 36.4 | None |
| | | | | | | | 168 | 10 | 100 | 47 | 47.5 | None | 170 | 70 | 63 | 18.4 | None | 50 | 80 | 57 | 30.3 | None |
| VP-26 | Benzotri-chloride | 5 | 940 | 400 | 68 | — | 72 | 160 | 110 | 51 | 43.7 | None | 330 | 90 | 65 | 17.7 | None | 210 | 100 | 58 | 32.0 | None |
| | | | | | | | 168 | 190 | 70 | 60 | 34.4 | Cracked | 410 | 70 | 72 | 14.2 | Cracked | 110 | 60 | 66 | 25.9 | Cracked |
| VP-27 | Benzotri-chloride | 10 | 1730 | 470 | 71 | — | 72 | 320 | 110 | 56 | 36.1 | None | 580 | 110 | 71 | 13.4 | None | 400 | 100 | 64 | 26.0 | None |
| | | | | | | | 168 | 250 | 70 | 66 | 30.8 | Cracked | 640 | 80 | 76 | 12.1 | None | 420 | 80 | 69 | 22.4 | None |

trile). The results of this work in Table IX show a comparison of Cab-O-Sil filled stocks, using Philprene VP-A and Philprene VP-25. Philprene VP-A was better at retaining tensile strength after aging. Although these limited results indicate some promise for this terpolymer, longer aging periods produced cracking, a deficiency found in all butadiene-containing polymers evaluated on this program.

Previous work with ethylacrylate copolymers* (Hycar 4021 and Acrylon EA-5) indicated that they might be suitable for high-temperature use in hydraulic fluids except for their very high brittle point. However, a butylacrylate copolymer (Acrylon BA-12, a copolymer of 88 per cent butyl acrylate and a 12 per cent acrylonitrile) has been claimed by its manufacturer to have a —65°F. brittle point if properly compounded.

The results of limited work on Acrylon BA-12 are shown in Table X. Except for Recipe PA-282, the results show that this polymer was unique, in that it had excellent resistance to cracking, even after extended aging. In addition, the results demonstrate that the target properties of tensile strength, elongation, and swell resistance might be approached with this polymer. Since not all properties were optimum in a single composition, it appears likely that by further adjustments in filler content, and possibly by employing combinations of fillers, it should be possible to obtain a better compromise of all properties in a single composition.

Since work with this polymer was started late in the program, further studies along this line were not undertaken. The brittle point, though about 12 degrees short of the —65°F. requirement, might be further lowered by judicious use of a plasticizer. These limited results indicate that Acrylon BA-12 has greater potential for satisfactory operation for 336 or 500 hours at 400°F. than has any of the other polymers evaluated.

Limited compounding studies were made on butyl rubber, Kel-F Elastomer, and Hycar 1072 (a carboxylic-modified nitrile polymer). None of these three polymers showed any promise for this application. During the aging period butyl rubber stocks disintegrated, Hycar 1072 stocks hardened excessively, while Kel-F Elastomer stocks were discovered to possess extremely low tensile strength.

## Comparisons of Polymers

In the preceding sections of this paper, the effect of compounding on the performance of individual polymers has been shown. Comparisons of the better recipes developed for each type of polymer are indicated in Table XI.

The original tensile strength requirement of 1500 psi minimum was easily met by rubber stocks based on neoprene and vinyl pyridine. However, after these stocks were aged, their tensile strengths dropped below the 800 psi minimum to about 500 to 600 psi. The best balanced butyl acrylate stock had a tensile strength of only 410 psi before aging, although certain stocks with poorer low-temperature properties reached 770 psi, with very little loss in tensile strength during aging. The best Hycar 1014 stock started with a tensile strength before aging of about 800 psi, decreased to about 600 psi after aging for 72 hours, and then gradually increased to about 1700 psi after prolonged aging. Actually, no stock prepared met the minimum tensile strength requirements after hot-oil aging in all three fluids.

* Mueller, W. J., and R. A. Clark, Ind. Eng. Chem., Vol. 48, p. 982 (1956).

TABLE VII—TEMPERATURE-RETRACTION TEST RESULTS

| Recipe | Base Polymer | Filler | TR-10, °C. | TR-70, °C. |
|---|---|---|---|---|
| N-3B | Neoprene WRT | Carbon black | —50 | —35 |
| 26C | Neoprene WRT | Carbon black | —50 | —18 |
| N-13 | Neoprene WRT | Cab-O-Sil | —48 | —2 |
| N-14 | Neoprene WRT | Silene EF | —48 | —5 |
| PA-282 | Acrylon BA-12 | Carbon black | —48 | +8 |
| VP-36 | Philprene VP-25 | Cab-O-Sil | —47 | —6 |
| VP-34 | Philprene VP-25 | Cab-O-Sil | —47 | —16 |
| A-384 | Hycar 1014 | ELC magnesia | —45 | —24 |
| PA-300 | Acrylon BA-12 | Carbon black | —43 | —19 |
| A-385 | Hycar 1014 | Hi-Sil | —41 | —4 |
| PA-302 | Acrylon BA-12 | Hi-Sil | —38 | +8 |
| PA-301 | Acrylon BA-12 | Silene EF | —33 | —16 |
| VP-37 | Philprene VP-A | Cab-O-Sil | —24 | —13 |
| A-377 | Hycar 1072 | Cab-O-Sil | —23 | +4 |
| KF-2 | Kel-F Elastomer | None | —1 | +7 |

The acrylate stocks were in a class by themselves for maintaining elongation after aging. After 500 hours of aging, these stocks maintained 400 to 500 per cent elongation. Some of the neoprene stocks, particularly Recipe N-101, maintained an elongation of about 150 per cent after aging for 168 hours, but were not evaluated for longer aging periods. Other stocks generally had an elongation of 100 per cent or less after aging. While there was no particular elongation at which cracking consistently occurred, it was evident that when the elongation dropped below 100 per cent, there was a good possibility that the sample would crack when bent double.

Almost all of the stocks had swell within the requirement of +5 to +30 per cent after aging in OS-45 and the blended fluid. The rubber swell after aging in MLO-8200 was generally lower, with values falling in the 0 to 30 per cent range.

In crack resistance, Acrylon BA-12 stocks were vastly superior to stocks based on other polymers. Except for one Acrylon BA-12 stock, believed to contain an excessive amount of vulcanizing agent, no cracking was noted with this type of polymer after oil aging for 500 hours at 400°F. Some of the best neoprene stocks were not cracked after aging for 168 hours, but were not tested for longer periods because of excessive loss in other properties.

Results indicate that for aging periods up to 168 hours, the neoprene stocks were best. For longer aging periods (up to 500 hours), the Acrylon BA-12 stocks showed the greatest promise.

In this report, little mention has been made of the comparative effect of the three hydraulic fluids on any one polymer. Actually, very few significant differences were noted among the three. One difference was that all polymers swelled less in MLO-8200 than in the other two fluids. Another observation was that neoprene and Philprene VP-25 lost more tensile strength after aging in OS-45 than when aged in the other fluids. The type of fluid used appeared to have no effect on the elongation, hardness, or crack resistance of the various stocks,

## TABLE VIII—THE AGING OF COMPOUNDS OF HYCAR 1014 AND PHILPRENE VP-25 BLENDS

Recipes used

| Ingredients | A-333 | A-334 | A-353 | A-354 | A-355 |
|---|---|---|---|---|---|
| | Parts by Weight | | | | |
| Hycar 1014 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Philprene VP-25 | — | — | 20.0 | 20.0 | 40.0 |
| ELC magnesia | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Zinc oxide | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Stearic acid | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| Plasticizer SC | — | 10.0 | — | — | — |
| Sulfur | 0.5 | 0.5 | 0.5 | 0.6 | 0.7 |
| Tetramethylthiuram disulfide | 0.25 | 0.25 | 0.25 | 0.3 | 0.35 |

Cure: 60 minutes at 310°F.

| | Original Physical Properties | | | | | Physical Properties After Aging in OS-45 at 400°F. | | | | | Physical Properties After Aging in MLO-8200 at 400°F. | | | | | Physical Properties After Aging in 85/15 MLO-8200/DOS Blend at 400°F. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Recipe | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Brittle Point, F | Aging Time, hours | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking |
| A-333 | 740 | 590 | 67 | —60 | 72 | 380 | 100 | 63 | 23.8 | None | 750 | 110 | 76 | 9.3 | None | 610 | 120 | 65 | 21.9 | None |
| | | | | | 168 | 420 | 70 | 76 | 20.2 | None | 1010 | 70 | 87 | 6.0 | None | 580 | 80 | 76 | 18.4 | None |
| A-334 | 670 | 760 | 50 | —62 | 72 | 190 | 110 | 58 | 20.0 | None | 470 | 130 | 65 | 7.3 | None | 390 | 160 | 56 | 19.2 | None |
| | | | | | 168 | 390 | 70 | 70 | 15.9 | None | 650 | 90 | 78 | 4.2 | None | 450 | 100 | 67 | 15.8 | None |
| | | | | | 336 | 1850 | 30 | 97 | 9.7 | Cracked | 1780 | 60 | 95 | 0.5 | Cracked | 1250 | 60 | 86 | 8.7 | Cracked |
| A-353 | 860 | 290 | 60 | — | 72 | 140 | 80 | 57 | 31.8 | None | 510 | 130 | 67 | 12.7 | None | 310 | 130 | 60 | 27.5 | None |
| | | | | | 168 | 170 | 80 | 62 | 29.6 | None | 560 | 70 | 79 | 10.3 | Cracked | 430 | 70 | 72 | 19.6 | Cracked |
| A-354 | 620 | 420 | 63 | —60 | 72 | 160 | 80 | 52 | 31.1 | None | 520 | 120 | 67 | 12.7 | None | 370 | 130 | 58 | 27.2 | None |
| | | | | | 168 | 290 | 60 | 70 | 27.6 | Cracked | 730 | 70 | 80 | 8.5 | Cracked | 470 | 80 | 71 | 20.7 | Cracked |
| | | | | | 336 | — | — | — | — | — | 3960 | 20 | 100+ | 0.9 | Cracked | 2910 | 30 | 100 | 10.2 | Cracked |
| A-355 | 830 | 550 | 57 | —70 | 72 | 20 | 110 | 44 | 41.5 | None | 350 | 130 | 63 | 14.8 | None | 210 | 140 | 52 | 32.6 | None |
| | | | | | 168 | 130 | 80 | 58 | 34.9 | None | 560 | 100 | 71 | 11.4 | None | 390 | 100 | 62 | 25.1 | None |
| | | | | | 336 | — | — | — | — | — | 3330 | 20 | 99 | 2.0 | Cracked | 1970 | 40 | 97 | 12.0 | Cracked |

## TABLE IX—THE AGING OF PHILPRENE VP-A AND PHILPRENE VP-25 COMPOUNDS USING CAB-O-SIL

Base recipe

| Ingredients | VP-37 | VP-38 | VP-34 | VP-36 |
|---|---|---|---|---|
| | Parts by Weight | | | |
| Philprene VP-A | 100.0 | 100.0 | — | — |
| Philprene VP-25 | — | — | 100.0 | 100.0 |
| Cab-O-Sil | 40.0 | 40.0 | 40.0 | 40.0 |
| Benzal chloride | 5.0 | — | 5.0 | — |
| Benzotrichloride | — | 5.0 | — | 5.0 |
| Zinc oxide | 3.0 | 3.0 | 3.0 | 3.0 |
| Stearic acid | 1.5 | 1.5 | 1.5 | 1.5 |
| Sulfur | 1.5 | 1.5 | 1.5 | 1.5 |
| Benzothiazyl disulfide | 1.5 | 1.5 | 1.5 | 1.5 |

Cure: 30 minutes at 310°F.

| | Original Physical Properties | | | | | Physical Properties After Aging in OS-45 at 400°F. | | | | | Physical Properties After Aging in MLO-8200 at 400°F. | | | | | Physical Properties After Aging in 85/15 MLO-8200/DOS Blend at 400°F. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Recipe | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Brittle Point, F | Aging Time, hours | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking |
| VP-37 | 2670 | 380 | 76 | —72 | 72 | 530 | 120 | 69 | 12.9 | None | 790 | 130 | 74 | 6.3 | None | 640 | 130 | 68 | 13.7 | None |
| | | | | | 168 | 730 | 70 | 79 | 11.2 | None | 1270 | 80 | 84 | 5.0 | None | 800 | 90 | 78 | 11.9 | None |
| | | | | | 336 | 1890 | 50 | 94 | 9.5 | Cracked | 2890 | 50 | 98 | 2.8 | Cracked | 1610 | 60 | 90 | 9.8 | Cracked |

## TABLE IX (Continued)

| Recipe | Original Physical Properties: Tensile Strength, psi | Elongation, % | Hardness, Shore A | Brittle Point, F | Aging Time, hours | Physical Properties After Aging in OS-45 at 400°F.: Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Physical Properties After Aging in MLO-8200 at 400°F.: Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Physical Properties After Aging in 85/15 MLO-8200/DOS Blend at 400°F.: Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VP-38 | 2970 | 370 | 78 | —45 | 72 | 700 | 110 | 73 | 10.5 | None | 1310 | 150 | 77 | 4.0 | None | 1200 | 160 | 73 | 11.0 | None |
| | | | | | 168 | 890 | 70 | 83 | 10.2 | Edge crack'g | 2070 | 100 | 91 | 3.3 | None | 1590 | 110 | 83 | 9.5 | None |
| | | | | | 336 | 2110 | 40 | 95 | 9.3 | Cracked | 3710 | 40 | 99 | 0.6 | Cracked | 2740 | 50 | 96 | 7.1 | Cracked |
| VP-34 | 2880 | 290 | 72 | —71 | 72 | 510 | 90 | 67 | 30.4 | None | 860 | 100 | 76 | 13.1 | None | 600 | 100 | 70 | 25.6 | None |
| | | | | | 168 | 600 | 80 | 73 | 26.4 | Cracked | 880 | 60 | 86 | 8.4 | Cracked | 470 | 60 | 78 | 19.4 | Cracked |
| | | | | | 336 | 590 | 50 | 81 | 20.2 | Cracked | 1630 | 40 | 92 | 4.5 | Cracked | 1020 | 40 | 92 | 4.5 | Cracked |
| VP-36 | 3320 | 300 | 77 | <—71 | 72 | 460 | 100 | 67 | 28.3 | None | 870 | 130 | 75 | 12.5 | None | 750 | 130 | 70 | 22.8 | None |
| | | | | | 168 | 470 | 80 | 71 | 25.3 | None | 1010 | 80 | 84 | 7.8 | Cracked | 750 | 90 | 76 | 18.6 | None |
| | | | | | 336 | 590 | 70 | 76 | 20.6 | Cracked | 1330 | 70 | 85 | 6.4 | Cracked | 1150 | 80 | 81 | 13.4 | Cracked |

## TABLE X—THE AGING OF ACRYLON BA-12 COMPOUNDS

| Ingredients | Base recipe, Parts by Weight: PA-282 | PA-300 | PA-301 | PA-302 |
|---|---|---|---|---|
| Acrylon BA-12 | 100.0 | 100.0 | 100.0 | 100.0 |
| Philblack E | 50.0 | —— | —— | —— |
| Philblack A | —— | 40.0 | —— | —— |
| Silene EF | —— | —— | 70.0 | —— |
| Hi-Sil | —— | —— | —— | 60.0 |
| Stearic acid | 1.0 | 1.0 | 1.0 | 1.0 |
| TP-90B | 20.0 | 20.0 | 20.0 | 20.0 |
| Sulfur | 1.0 | 0.9 | 0.9 | 0.9 |
| Tetramethylthiuram disulfide | —— | 1.0 | 1.0 | 1.0 |
| Triethylene tetramine | 5.0 | 2.1 | 2.1 | 2.1 |

Cure: 60 minutes at 310°F.

| Recipe | Original Physical Properties: Tensile Strength, psi | Elongation, % | Hardness, Shore A | Brittle Point, F | Aging Time, hours | Physical Properties After Aging in OS-45 at 400°F.: Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Physical Properties After Aging in MLO-8200 at 400°F.: Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Physical Properties After Aging in 85/15 MLO-8200/DOS Blend at 400°F.: Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PA-282 | 1040 | 70 | 90 | —53 | 72 | 550 | 70 | 82 | 10.7 | None | 830 | 60 | 89 | 0.5 | Cracked | 560 | 70 | 82 | 12.9 | None |
| | | | | | 168 | 320 | 50 | 80 | 12.9 | Cracked | 690 | 70 | 89 | 1.6 | Cracked | 470 | 70 | 81 | 12.1 | Cracked |
| PA-300 | 720 | 240 | 59 | —53 | 72 | 410 | 200 | 49 | 23.0 | None | 580 | 210 | 58 | 6.9 | None | 350 | 190 | 49 | 23.7 | None |
| | | | | | 168 | 450 | 210 | 51 | 21.8 | None | 570 | 180 | 65 | 5.0 | None | 470 | 210 | 52 | 20.3 | None |
| | | | | | 336 | 190 | 240 | 39 | 35.5 | None | 420 | 190 | 56 | 7.6 | None | 230 | 230 | 40 | 27.2 | None |
| | | | | | 500 | 250 | 230 | 42 | 29.9 | None | 410 | 200 | 53 | 7.6 | None | 200 | 200 | 43 | 26.2 | None |
| PA-301 | 670 | 240 | 67 | —8 | 72 | 770 | 100 | 83 | —2.9 | None | 870 | 100 | 86 | —5.7 | None | 790 | 110 | 83 | —2.2 | None |
| | | | | | 168 | 740 | 90 | 80 | 0.5 | None | 800 | 90 | 85 | —3.8 | None | 760 | 100 | 84 | —2.2 | None |
| | | | | | 336 | 710 | 90 | 76 | 14.0 | None | 870 | 80 | 84 | —0.7 | None | 910 | 90 | 80 | 2.2 | None |
| | | | | | 500 | 680 | 80 | 77 | 9.7 | None | 890 | 70 | 85 | —2.7 | None | 830 | 80 | 81 | 1.4 | None |
| PA-302 | 310 | 530 | 71 | —39 | 72 | 370 | 560 | 54 | 25.6 | None | 730 | 530 | 67 | 11.0 | None | 430 | 540 | 48 | 26.4 | None |
| | | | | | 168 | 390 | 530 | 49 | 29.7 | None | 600 | 520 | 65 | 10.6 | None | 390 | 520 | 47 | 31.1 | None |
| | | | | | 336 | 130 | 430 | 42 | 31.0 | None | 450 | 500 | 59 | 12.4 | None | 200 | 470 | 42 | 28.5 | None |
| | | | | | 500 | 10 | 380 | 38 | 27.4 | None | 390 | 450 | 57 | 14.1 | None | 200 | 450 | 39 | 28.2 | None |

## TABLE XI—COMPARISONS OF BETTER STOCKS

| Ingredients | Base recipes (Parts by Weight) A-385 | VP-36 | VP-37 | VP-38 | PA-300 | PA-302 |
|---|---|---|---|---|---|---|
| Hycar 1014 | 100.0 | — | — | — | — | — |
| Philprene VP-25 | — | 100.0 | — | — | — | — |
| Philprene VP-A | — | — | 100.0 | 100.0 | — | — |
| Acrylon BA-12 | — | — | — | — | 100.0 | 100.0 |
| Hi-Sil | 60.0 | — | — | — | — | 60.0 |
| Cab-O-Sil | — | 40.0 | 40.0 | 40.0 | — | — |
| Philblack A | — | — | — | — | 40.0 | — |
| Zinc oxide | 5.0 | 3.0 | 3.0 | 3.0 | — | — |
| Stearic acid | 1.5 | 1.5 | 1.5 | 1.5 | 1.0 | 1.0 |
| Plasticizer SC | 1.0 | — | — | — | — | — |
| TP-90B | — | — | — | — | 20.0 | 20.0 |
| Sulfur | 0.5 | 1.5 | 1.5 | 1.5 | 0.9 | 0.9 |
| Tetramethylthiuram disulfide | 0.25 | — | — | — | 1.0 | 1.0 |
| Benzothiazyl disulfide | — | 1.5 | 1.5 | 1.5 | — | — |
| Triethylene tetramine | — | — | — | — | 2.1 | 2.1 |
| Benzotrichloride | — | 5.0 | — | 5.0 | — | — |
| Benzal chloride | — | — | 5.0 | — | — | — |
| Cure, minutes at 310°F. | 60 | 30 | 30 | 30 | 60 | 60 |

| Ingredients | Neoprene base recipes (Parts by Weight) N-34 | N-14 | N-13 | N-101 | N-3B |
|---|---|---|---|---|---|
| Neoprene WRT | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Magnesia | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Continex SRF | 15.0 | — | — | — | 40.0 |
| Thermax | 15.0 | — | — | — | 40.0 |
| Silene EF | — | 60.0 | — | — | — |
| Cab-O-Sil | — | — | 45.0 | 40.0 | — |
| Butyl oleate | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| Zinc oxide | 80.0 | 2.5 | 2.5 | 2.5 | 2.5 |
| NA-22 | 1.0 | 1.0 | 1.0 | 0.6 | 1.0 |

N-3B cured 20 minutes at 310°F. All others cured 30 minutes at 310°F.

| Recipe | Base Polymer | Original Physical Properties: Tensile Strength, psi | Elongation, % | Hardness, Shore A | Brittle Point, F | Aging Time, hours | Physical Properties After Aging in OS-45 at 400°F.: Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Physical Properties After Aging in MLO-8200 at 400°F.: Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking | Physical Properties After Aging in 85/15 MLO-8200/DOS Blend at 400°F.: Tensile Strength, psi | Elongation, % | Hardness, Shore A | Swell, % | Cracking |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-385 | Hycar 1014 | 800 | 640 | 56 | —54 | 72 | 600 | 90 | 77 | 15.6 | None | 770 | 80 | 86 | 4.6 | Cracked | 580 | 90 | 77 | 14.3 | None |
| | | | | | | 168 | 940 | 50 | 89 | 12.4 | Cracked | 1490 | 50 | 93 | 1.7 | Cracked | 1080 | 60 | 89 | 9.5 | Cracked |
| | | | | | | 336 | 1670 | 40 | 93 | 11.4 | Cracked | 3100 | 20 | 98 | —0.5 | Cracked | 2130 | 40 | 95 | 5.9 | Cracked |
| VP-36 | Philprene VP-25 | 3320 | 300 | 77 | <—71 | 72 | 460 | 100 | 67 | 28.3 | None | 870 | 130 | 75 | 12.5 | None | 750 | 130 | 70 | 22.8 | None |
| | | | | | | 168 | 470 | 80 | 71 | 25.3 | None | 1010 | 80 | 84 | 7.8 | Cracked | 750 | 90 | 76 | 18.6 | None |
| | | | | | | 336 | 590 | 70 | 76 | 20.6 | Cracked | 1330 | 70 | 85 | 6.4 | Cracked | 1150 | 80 | 81 | 13.4 | Cracked |
| VP-37 | Philprene VP-A | 2670 | 380 | 76 | —72 | 72 | 530 | 120 | 69 | 12.9 | None | 790 | 130 | 74 | 6.3 | None | 640 | 130 | 68 | 13.7 | None |
| | | | | | | 168 | 730 | 70 | 79 | 11.2 | None | 1270 | 80 | 84 | 5.0 | None | 800 | 90 | 78 | 11.9 | None |
| | | | | | | 336 | 1890 | 50 | 94 | 9.5 | Cracked | 2890 | 50 | 98 | 2.8 | Cracked | 1610 | 60 | 90 | 9.8 | Cracked |
| VP-38 | Philprene VP-A | 2970 | 370 | 78 | —45 | 72 | 700 | 110 | 73 | 10.5 | None | 1310 | 150 | 77 | 4.0 | None | 1200 | 160 | 75 | 11.0 | None |
| | | | | | | 168 | 890 | 70 | 83 | 10.2 | Edge crack'g | 2070 | 100 | 91 | 3.3 | None | 1590 | 110 | 83 | 9.5 | None |
| | | | | | | 336 | 2110 | 40 | 95 | 9.3 | Cracked | 3710 | 40 | 99 | 0.6 | Cracked | 2740 | 50 | 96 | 7.1 | Cracked |
| PA-300 | Acrylon BA-12 | 720 | 240 | 59 | —53 | 72 | 410 | 200 | 49 | 23.0 | None | 580 | 210 | 58 | 6.9 | None | 350 | 190 | 49 | 23.7 | None |
| | | | | | | 168 | 450 | 210 | 51 | 21.8 | None | 570 | 180 | 65 | 5.0 | None | 470 | 210 | 52 | 20.3 | None |
| | | | | | | 336 | 190 | 240 | 39 | 35.5 | None | 420 | 190 | 56 | 7.6 | None | 230 | 230 | 40 | 27.2 | None |
| | | | | | | 500 | 250 | 230 | 42 | 29.9 | None | 410 | 200 | 53 | 7.6 | None | 200 | 200 | 43 | 26.2 | None |
| PA-302 | Acrylon BA-12 | 310 | 530 | 71 | —39 | 72 | 370 | 560 | 54 | 25.6 | None | 730 | 530 | 67 | 11.0 | None | 430 | 540 | 48 | 26.4 | None |
| | | | | | | 168 | 390 | 530 | 49 | 29.7 | None | 600 | 520 | 65 | 10.6 | None | 390 | 520 | 47 | 31.1 | None |
| | | | | | | 336 | 130 | 430 | 42 | 31.0 | None | 450 | 500 | 59 | 12.4 | None | 200 | 470 | 42 | 28.5 | None |
| | | | | | | 500 | 10 | 380 | 38 | 27.4 | None | 390 | 450 | 57 | 14.1 | None | 200 | 450 | 39 | 28.2 | None |
| N-34 | Neoprene WRT | 1540 | 370 | 66 | —60 | 72 | 670 | 150 | 66 | 6.0 | None | 1670 | 140 | 79 | —0.4 | None | 930 | 150 | 69 | 9.6 | None |
| | | | | | | 168 | 930 | 90 | 82 | 3.5 | Cracked | 4630 | 10 | 100 | 15.9 | Cracked | 890 | 100 | 79 | 15.0 | None |
| N-14 | Neoprene WRT | 1400 | 600 | 66 | —— | 72 | 450 | 130 | 65 | 7.4 | None | 860 | 180 | 72 | —3.3 | None | 530 | 190 | 61 | 10.5 | None |
| | | | | | | 168 | 450 | 100 | 68 | 5.9 | None | 750 | 140 | 74 | —1.9 | None | 590 | 160 | 66 | 10.0 | None |
| N-13 | Neoprene WRT | 2400 | 620 | 73 | —— | 72 | 970 | 160 | 88 | 9.4 | None | 1350 | 170 | 89 | 1.6 | None | 1050 | 210 | 85 | 12.8 | None |
| | | | | | | 168 | 550 | 90 | 80 | 24.9 | None | 890 | 10 | 96 | 28.3 | Cracked | 660 | 130 | 75 | 26.6 | None |
| N-101 | Neoprene WRT | 3010 | 700 | 68 | —— | 72 | 910 | 250 | 75 | 10.8 | None | 1520 | 320 | 80 | 3.0 | None | 950 | 280 | 75 | 12.8 | None |
| | | | | | | 168 | 790 | 140 | 87 | 11.2 | None | —Cap blew off test tube— | | | | | 630 | 170 | 69 | 28.1 | None |
| N-3B(26-C) | Neoprene WRT | 2270 | 230 | 68 | —— | 72 | 710 | 70 | 76 | 11.4 | None | 1240 | 70 | 83 | 10.5 | Cracked | 1090 | 120 | 71 | 11.5 | None |
| | | | | | | 168 | 640 | 40 | 84 | 14.0 | Cracked | 1840 | 10 | 100 | 38.6 | Cracked | 1300 | 60 | 85 | 22.1 | Cracked |

since comparable results for these properties were found when the various polymers were aged in the three fluids.


### Summary

Studies were made on several polymers to develop a rubber composition which would resist degradation when aged for periods up to 500 hours at 400°F in silicate-ester hydraulic fluids. For long aging periods (336 to 500 hours), the best results were obtained with Acrylon BA-12 stocks. Although the tensile strength with this polymer was low, the stocks did not harden or crack due to aging. Philblack A or Hi-Sil were found to be the best fillers, and the best compositions were vulcanized with a mixture of sulfur, tetramethylthiuram disulfide, and triethylenetetramine.

Unsaturated polymers, such as Philprene VP-25, Philprene VP-A, and Hycar 1014, showed some promise for short aging periods (72 to 168 hours), but always hardened and cracked on prolonged aging.



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## Steam and the Cleaning of Belting

THE utmost caution must always be exercised in the use of steam for cleaning belting. Steam is an excellent cleanser for many purposes, but it must be remembered that many kinds of belting cannot withstand the high temperatures that go with steam. The temperature of steam at atmospheric pressure is 212°F. The higher the steam pressure, the higher the corresponding temperature.

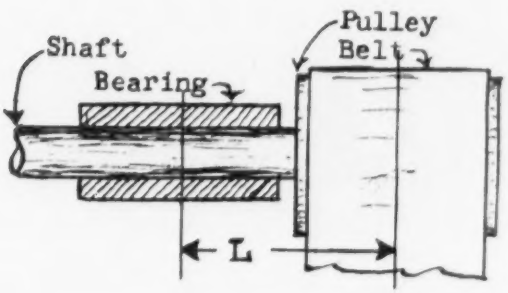
A temperature of 212°F. is too hot for most rubber belting. One prominent rubber belt manufacturer states that his belting is not affected by heat up to a temperature of 200°F., but adds that if higher temperatures are to be encountered, he should first be consulted. That is good advice regardless of the kind of belt. Even if steel chains are used, one must be careful in using high temperatures, or lubrication difficulties will be experienced. Of course, steel chains can be cleaned safely with steam.

Balata belting is more sensitive to high temperatures than rubber. Its temperature should be kept down to less than 110°F. At 125°F. balata gum can be molded. According to one well known authority on the subject, oak-tanned leather belting should not be subjected to a temperature higher than 115°F., which means, of course, that oak belting should never be cleaned with steam.

Nor should impregnated cotton belting be cleaned with steam because the steam will very likely wash out the impregnating compound. Without the compound cotton belting does not give satisfactory results. Stitched canvas belting should not be used in temperatures higher than 140°F. Not many types of belts, then, can be steam-cleaned with safety. The utmost caution, therefore, must always be exercised. W.F.S.

## Narrower Drives Mean Higher Efficiency

THE accompanying sketch shows clearly why wide drives and wide bearings are being discarded in our rubber factories and replaced by narrow drives, such as chains, and narrow bearings, such as ball bearings. The principle involved hinges on the distance "L," which should be as short as practicable. It is difficult to make the distance "L" short with ordinary belts and ordinary bearings, as shown in the sketch. "L" is the "lever arm" between the center of the pulley or other drive and the center of the bearing. The greater the distance "L," the larger must be the shaft to withstand the bending.




One manufacturer has found that in many instances the first cost of the machine, with highest efficiency ball bearings and chain drives, will actually be less than the first cost of the same machine equipped with less efficient wide drives and sleeve bearings. In addition, the weight of the machine is less, freight costs are less, the machine occupies less space, and its all-around efficiency and economy are higher. It is a better and more modern machine in every way. These are the things that rubber factory machine designers and builders think of and apply in their day to day and year to year work of making rubber factory machinery as close to perfect as possible. W.F.S.

# The Pandux Tester

## for determining the comparative resistance values of latex foam rubber materials

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AN investigation was made to determine the suitability of the Pandux tester for obtaining the compression resistance values of latex foam rubber materials. A preliminary study was conducted to establish conditions for using the Pandux tester. Following this, comparative tests were made on 11 samples of latex foam rubber at room temperature and at —20°F. with both the Pandux tester and a compression resistance apparatus. The specimens were randomized and the data obtained were analyzed statistically to determine the residual error inherent in tests using the two types of equipment. The relative merits of the Pandux tester for determining the comparative resistance values of the foam rubber materials in factory and laboratory are discussed.

### Compression Resistance and Indentation Tests

Compression resistance and indentation tests are used at present to determine the condition and grade, respectively, of latex foam rubber materials. For example, in Military Specification MIL-R-0020092 *(1)*, latex foams are classified as soft, medium or firm depending upon the compression resistance, which is defined as the stress in psi required to cause a strain of 25 per cent. In ASTM Method D1055 *(2)*, the load in pounds required to cause a 25 per cent compression in a specimen having an area of 50 square inches is used to distinguish between different grades of material.

The determination of compression resistance and indentation of latex foam rubbers generally involves bulky test apparatus to measure the force required to compress a sample exactly 25 per cent of its original height. In addition, this determination is not readily adaptable for performing inspection and production check tests in a factory.

As a matter of convenience, a small hand instrument which could be used to measure the compression resistance and indentation of latex foam rubbers as a function of a more readily measurable property would be desirable. The Pandux hardness tester was claimed by the manufacturer to be such an instrument. Accordingly, materials being conducted under the general direction of T. A. Werkenthin of the Bureau of Ships, Navy Department, an investigation was undertaken to determine

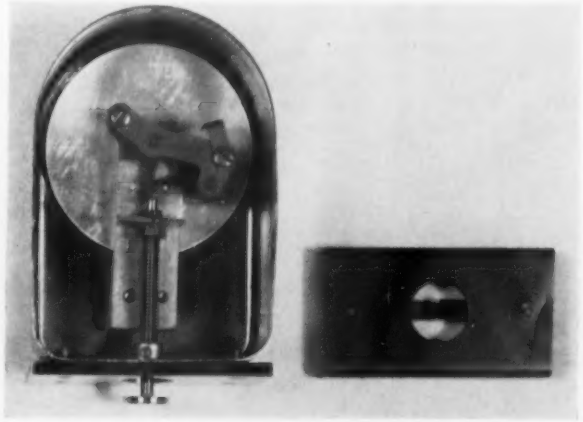

FIG. 1—Interior view of the Pandux tester and the underside of the calibration standard. The Pandux tester is 2¼ inches wide.

The opinions and assertions contained herein are those of the author and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

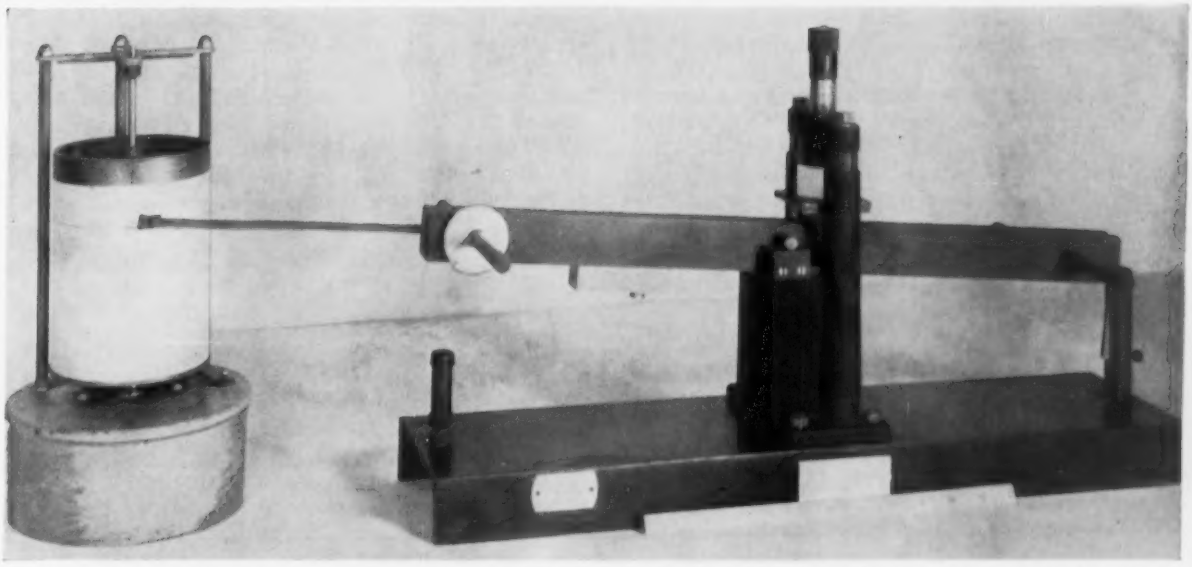

FIG. 2—Apparatus used to measure the compression resistance of latex foam samples to give a standard of comparison with the Pandux tester.

the relationship between hardness results obtained on representative samples of latex foam rubber materials using the Pandux tester, and the compression resistance values determined as specified in Military Specification MIL-R-0020092 *(1)*.

## Pandux Tester

The Model 302S Pandux tester shown at the beginning of this article is manufactured by the Pacific Transducer Corp. It measures 3½ x 2¼ x 1¼ inches and weighs 193 grams. The dial is divided into 100 equal but unspecified units of hardness.

The Pandux tester with the back cover removed and the underside of its calibration standard are shown in Figure 1. The instrument indentor measures 0.452 inch in diameter by 1/16 inch thick, and is secured to a shaft that is guided by sleevelike bearings to move in a direction perpendicular to the base of the tester. Secured to the shaft at a predetermined location is a collar, seen in Figure 1 in contact with the base. A compression spring is coiled around the shaft and is positioned to exert pressure on the top of the collar to force the indentor out from the tester. In the position shown in Figure 1, this force is counterbalanced by an equal force that the base exerts against the bottom of the collar.

The upper end of the shaft is in contact with a lever and pinion gear arrangement connected to the pointer on the dial so that the motion of the indentor relative to the base is magnified and measured on the dial. The arrangement of the tester is such that the dial reading is proportional to the extension of the indentor from the base and is thus dependent upon the degree to which the spring can depress the indentor into the latex foam rubber sample.

The calibration standard consists of a channel shaped steel bar having a centrally located circular opening larger in diameter than the indentor. Two springs located on the underside of the channel section are preset so that the Pandux tester when properly calibrated reads the number of units stamped on the standard.

## Testing Procedure

The techniques to be followed in using the Pandux tester were standardized by first determining:

(a) The minimum size specimen which should be used in a test.

(b) The force with which the tester should be held against the latex foam rubber specimen.

(c) The time interval before making a reading, measured from the instant the tester contacts the latex foam rubber specimen.

Based on these preliminary investigations, it was decided to use specimens 3 x 3 x 1 inch, to place the Pandux tester onto the specimen without additional external load, and to read the hardness 15 seconds thereafter. This procedure conforms with the recommendations made by the manufacturer of the Pandux tester. The 15 second time lag is the same as that used in many military specifications for making hardness tests on elastomers with the Shore durometer.

## Compression Resistance Apparatus

The compression resistance apparatus used as a standard for comparison with the Pandux tester is shown in Figure 2. This apparatus consists basically of a balanced lever onto which weights are added on one end at one minute intervals to cause 25 per cent compression of a specimen of latex foam rubber. The compression is recorded on graph paper coiled on the rotating drum seen in Figure 2.

The following procedure is used to determine the compression resistance of one specimen with this apparatus: (a) Position the specimen on the apparatus; (b) Perform several alternate compressions and decompressions of the specimen to eliminate trapped air; (c) Balance the instrument lever and fasten the lever to the hook; (d) Adjust the micrometer head; (e) Draw a reference line on a chart secured to the recording drum; (f) Determine the proper weights (a minimum of four equal weights) to compress the specimen at least 25

TABLE I—LATEX FOAM RUBBER SAMPLES

| Code (1) | Manufacturer's Designation in Accordance with Specification MIL-R-0020092 Type | Class | Condition | No. of Samples Used | Size of Sample in Inches | Basic Elastomeric Ingredient |
|---|---|---|---|---|---|---|
| AA22S | 2 | 2 | Soft | 2 | 10 x 14 x 1 | GR-S type rubber |
| AA22M | 2 | 2 | Medium | 1 | " | " |
| AA22F | 2 | 2 | Firm | 2 | " | " |
| AB22S | 2 | 2 | Soft | 1 | " | 75% natural rubber and 25% |
| AB22M | 2 | 2 | Medium | 1 | " | GR-S type rubber (2) |
| AB22F | 2 | 2 | Firm | 1 | " | " |
| B21S | 2 | 1 | Soft | 2 | 12 x 12 x 1 | Neoprene |
| B21M | 2 | 1 | Medium | 2 | " | " |
| B21F | 2 | 1 | Firm | 2 | " | " |
| C21S | 2 | 1 | Soft | 2 | 10 x 10 x 1 | " |
| C21F | 2 | 1 | Firm | 1 | " | " |

(1) The last three symbols in the code designation refer to type, class and condition of latex foam rubber in accordance with specification MIL-R-0020092.
(2) Non-conformity with material requirement of specification MIL-R-0020092.

per cent; (g) Add the necessary weights to the lever arm at one minute intervals until the specimen is compressed at least 25 per cent; (h) Measure on the chart the amount of compression of the specimen caused by each weight; (i) Plot a stress-strain curve for the specimen, and (j) Determine from the stress-strain curve the stress (in psi) required to compress the specimen 25 per cent.

## Selection of Samples

Eleven latex foam rubber samples received from three manufacturers were used in this investigation. These samples, listed in Table I, are identified by code letters in order not to violate commercial confidences.

The effect of variation in hardness properties of specimens from different sections of the same slab, and from different slabs of the same material was minimized by assigning specimens cut from specific locations for each test condition in accordance with a statistical plan. Where two slabs of material were available each of them was marked to provide nine specimens numbered from 1 to 9 and 10 to 18, respectively. Where only one slab of material was available, this slab was divided to provide twelve specimens. Specimens 3 inches square by 1 inch thick, and 1⅝ inch in diameter by 1 inch thick were prepared from these slabs for tests using the Pandux tester and compression resistance apparatus, respectively.

The Pandux hardness and compression resistance tests were made in triplicate in accordance with the statistical plan wherein specimens from specific locations in the

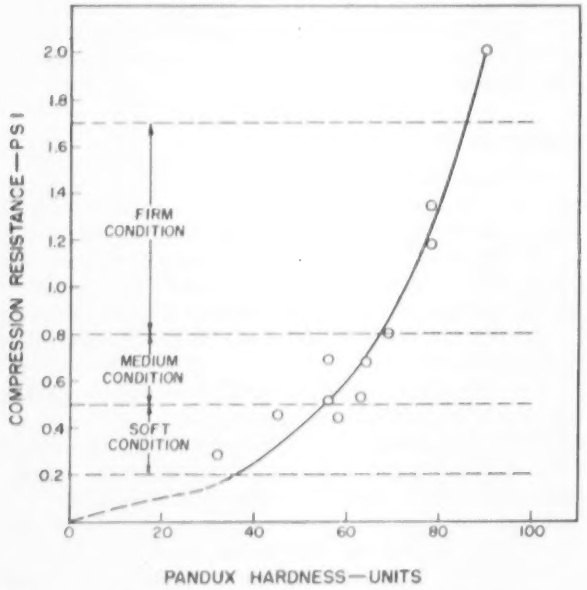


FIG. 3—The Pandux hardness versus compression resistance of the latex foam rubber samples when they were tested at room temperature.

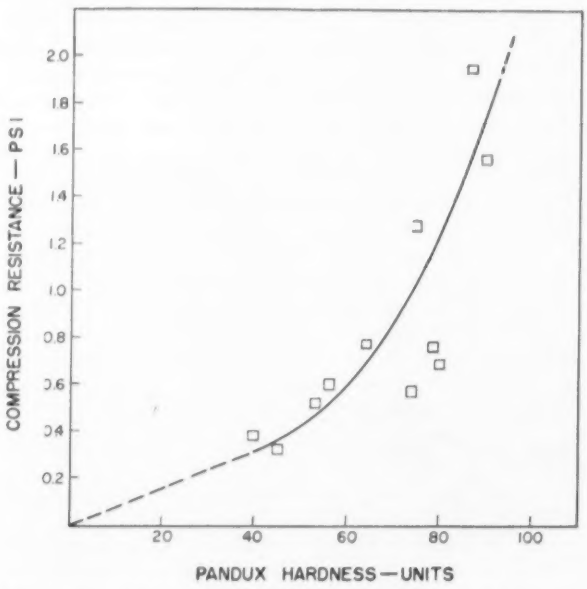


FIG. 4—Pandux hardness versus compression resistance of the samples tested at —20°F. after exposure for 5 hours at that temperature.

slabs were subjected to the test conditions. The specimens prepared from two slabs of the same material were tested to determine the Pandux hardness and compression resistance in the initial condition, and after aging in a Geer oven for 70 hours at 212° ±2°F., and also at —20°F. after conditioning the specimens for 5 hours at this temperature. The twelve specimens prepared from one slab were tested in the initial condition and at —20°F. after conditioning the specimens for 5 hours at this temperature.

## Results of the Tests

The Pandux hardness and compression resistance results obtained on each specimen are tabulated in Table II. Each result shown in Table II for the Pandux tester is the average of five readings obtained on a specimen whereas each of the results shown for compression resistance is the stress (in psi) required to compress the specimen 25 per cent of its original height. Average values are tabulated for the three specimens of each sample subjected to each condition of test.

Statistical analysis using the methods of the analysis of variance on the results in Table II indicate that the residual experimental error (which may be considered a measure of the precision of the instrument) is 2.6 per cent for the Pandux tester and 4.3 per cent for the compression resistance apparatus.

The average values of Pandux hardness obtained on each sample in the initial condition and at —20°F. versus the corresponding compression resistance values are represented graphically in Figures 3 and 4, respectively.

## Calibration of Pandux Tester

The relationship between the force exerted on the instrument indentor and the resulting Pandux hardness reading was determined using the apparatus shown in Figure 5. Essentially this apparatus is similar to that used in ASTM Method D676 *(3)* to obtain the calibration curve for the Shore durometer. It provides a means for determining the force exerted by the indentor at different Pandux dial readings. In addition

TABLE II—PANDUX TESTER HARDNESS AND COMPRESSION RESISTANCE RESULTS

| Test | Sample | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | AA22S | AA22M | AA22F | AB22S | AB22M | AB22F | B21S | B21M | B21F | C21S | C21F |
| | Pandux Hardness, units | | | | | | | | | | |
| I(1) | 56 | 68 | 89 | 44 | 55 | 77 | 34 | 63 | 64 | 61 | 77 |
| | 58 | 69 | 90 | 47 | 57 | 80 | 29 | 61 | 64 | 56 | 78 |
| | 55 | 71 | 90 | 45 | 57 | 78 | 32 | 64 | 65 | 58 | 79 |
| Avg. | 56 | 69 | 90 | 45 | 56 | 78 | 32 | 63 | 64 | 58 | 78 |
| A(2) | 46 | —(4) | 85 | — | — | — | 33 | 64 | 67 | 50 | — |
| | 47 | — | 86 | — | — | — | 32 | 63 | 66 | 52 | — |
| | 48 | — | 86 | — | — | — | 33 | 64 | 64 | 49 | — |
| Avg. | 47 | | 86 | | | | 33 | 64 | 66 | 50 | |
| L(3) | 53 | 63 | 85 | 40 | 57 | 76 | 45 | 79 | 78 | 72 | 90 |
| | 50 | 64 | 88 | 40 | 55 | 75 | 46 | 80 | 80 | 74 | 89 |
| | 57 | 64 | 89 | 40 | 56 | 75 | 44 | 80 | 79 | 75 | — |
| Avg. | 53 | 64 | 87 | 40 | 56 | 75 | 45 | 80 | 79 | 74 | 90 |
| | Compression Resistance, pounds per square inch | | | | | | | | | | |
| I(1) | 0.50 | 0.79 | 1.86 | 0.45 | 0.68 | 1.38 | 0.30 | 0.52 | 0.68 | 0.42 | 1.18 |
| | 0.53 | 0.82 | 2.10 | 0.46 | 0.70 | 1.28 | 0.27 | 0.56 | 0.66 | 0.44 | 1.17 |
| | 0.51 | 0.80 | 2.05 | 0.45 | 0.69 | 1.35 | 0.30 | 0.52 | 0.69 | 0.45 | — |
| Avg. | 0.51 | 0.80 | 2.00 | 0.45 | 0.69 | 1.34 | 0.29 | 0.53 | 0.68 | 0.44 | 1.18 |
| A(2) | 0.43 | — | 1.83 | — | — | — | 0.22 | 0.47 | 0.63 | 0.32 | — |
| | 0.38 | — | 1.90 | — | — | — | 0.24 | 0.46 | 0.64 | 0.33 | — |
| | 0.43 | — | 1.71 | — | — | — | 0.23 | 0.46 | 0.65 | 0.33 | — |
| Avg. | 0.41 | | 1.81 | | | | 0.23 | 0.46 | 0.64 | 0.33 | |
| L(3) | 0.52 | 0.76 | 1.88 | 0.37 | 0.62 | 1.28 | 0.36 | 0.69 | 0.77 | 0.59 | 1.49 |
| | 0.55 | 0.79 | 1.92 | 0.41 | 0.59 | 1.29 | 0.31 | 0.71 | 0.77 | 0.53 | 1.62 |
| | 0.49 | 0.76 | 2.05 | 0.36 | 0.60 | 1.27 | 0.29 | 0.66 | 0.78 | 0.59 | — |
| Avg. | 0.52 | 0.77 | 1.95 | 0.38 | 0.60 | 1.28 | 0.32 | 0.69 | 0.77 | 0.57 | 1.56 |

(1) Specimens tested in the initial condition at room temperature.
(2) Specimens aged in a Geer oven for 70 hours at 212±2°F., then permitted to cool to room temperature for at least one day and then tested at room temperature.
(3) Specimens tested at —20°F. after conditioning for five hours at that temperature.
(4) A dash indicates that no sample was available for test.

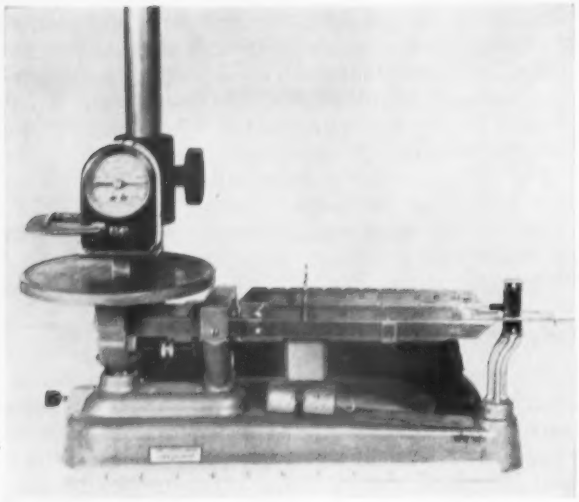

FIG. 5—Apparatus used to obtain the calibration curve of the Pandux tester. It correlates the force exerted with the dial readings.

to testing in the upright position, the Pandux tester was inverted so that the indentor was topmost. Weights were then applied onto the indentor and the resulting Pandux dial reading was recorded.

The calibration data for the Pandux tester are tabulated in Table III and are shown graphically in Figure 6. The difference in force required to obtain Pandux readings in the upright and inverted positions is due to the weight of the indentor, spring, lever and other appurtenances resting on the indentor. In the upright position, the force due to these weights assists, and in the inverted position the force due to these weights opposes the spring force. Thus, the total weight of these appurtenances is one-half the difference between the forces required to obtain the same Pandux reading

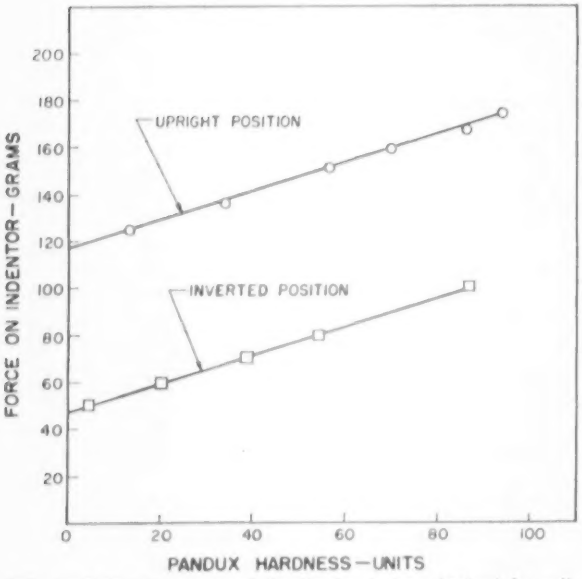


FIG. 6—Calibration curve of the Pandux tester, obtained by calibrating the Pandux tester readings against the primary standard.

TABLE III—CALIBRATION DATA OF PANDUX TESTER

| Upright Position | | Inverted Position | |
|---|---|---|---|
| Force, grams | Pandux Dial Reading, units | Force, grams | Pandux Dial Reading, units |
| 125.2 | 13.5 | 50 | 4 |
| 135.2 | 34 | 60 | 20 |
| 151.4 | 56.5 | 70 | 39 |
| 158.8 | 70 | 80 | 54 |
| 166.7 | 86.5 | 100 | 87 |
| 174.9 | 94 | | |

in the upright and inverted positions, and is equal to approximately 35 grams.

## Summary

The Pandux tester appears to be capable of determining the soft, medium and firm condition of latex foam rubber materials. However, the relationship between the Pandux hardness and compression resistance values is not precise and borderline samples may be classified under one condition using Pandux hardness readings and under another condition using compression resistance values. For minimum variation in results, Pandux hardness readings should be obtained by placing the Pandux tester on the latex foam rubber specimen and noting the reading 15 seconds afterwards.

It is significant to note that only one Pandux tester was used in this investigation and that there may be differences in results obtained with different testers. In order for Pandux testers to give comparable results, it is necessary that the following features be identical: (a) calibration curve; (b) geometry of the indentor, and (c) initial extension of the indentor from the base.

The Pandux tester has advantageous features in that there is no limit (except for a minimum of 3 inches square by 1 inch) to the size of specimens that can be tested. Also, the Pandux tester can be used to determine rapidly and conveniently the hardness of both cored and uncored material in the factory and in a testing laboratory.

Based on these considerations, the Pandux tester has merit for use as a production check instrument for latex foam rubber samples provided that it can be calibrated against a primary standard, such as a gram balance.

ACKNOWLEDGMENT

The author acknowledges the assistance of E. Garde in conducting the required tests.

LITERATURE REFERENCES

(1) Military Specification MIL-R-0020092 (Ships) of 16 May 1956, "Rubber Sheets and Molded Shapes, Synthetic, Exploded Cell (Foamed Latex)."

(2) American Society for Testing Materials Designation D1055, "Tentative Specifications and Methods of Test for Latex Foam Rubbers."

(3) American Society for Testing Materials Designation D676, "Tentative Method of Test for Indentation of Rubber by Means of a Durometer."

**PROCEDURE IN OBTAINING PATENTS Part 2**

By Kenneth W. Brown

Assisted by Arthur S. Collins and Curt B. Beck

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# How to Prepare the Patent Application

***It takes know-how to prepare an application which will pass with minimum difficulty and give maximum patent value; hints are given, with the history of one application to show what happens***

THE work of the inventor does not end with the completion of his invention. The preparation and prosecution of a patent application afford further opportunities for the inventor to make important contributions to the success of his endeavors. Subsequently, we shall see something of the patience and determination required in dealing with the Patent Office to obtain sound patent protection.

The mature brainchild should be introduced to the patent attorney.

The actual preparation and prosecution of a patent application are primarily the responsibility of the patent attorney. However, close cooperation between the inventor and his patent attorney or agent is generally necessary if the most extensive protection possible is to be obtained.

Once an inventor has come to regard one of his brainchildren as having reached maturity, he should introduce it to the patent attorney. When he is satisfied that invention is involved, he should prepare a patent disclosure in as much detail as possible. If he is in doubt as to patentability, or if further experimental work is required, he may first make informal inquiry of the attorney and obtain advice as to further procedure. Under no circumstances should he delay revelation of his invention. There is real danger in waiting too long to call attention to a worthy invention because a valid patent cannot issue on an invention unless an application is filed within a year after the first published description or its first public use.

On the other hand, it is never too early to seek patent assistance, and the work of establishing the patentable merit of a given invention and reducing it to practice may be considerably simplified through early consultation with one's patent advisers. For example, it may be possible to avoid unnecessary entanglement with known prior art and/or duplication of work within a given field.

In the absence of a deadline set by commercial use or publication, etc., the question of when to file an application is often difficult to resolve. If there is no expectation of conducting experimental work in the immediate future, one may as well go ahead and prepare an application and get it on file as soon as possible.

There is no objection to filing an application based strictly on theoretical reasoning and predicted performance. Many patents, commonly referred to as "paper patents," have issued on applications with no firmer bases and have survived litigation. However, it goes without saying that any patent which stems from experimen-

tation will be all the stronger. Hence, some delay in preparing a patent application is warranted when further investigation is projected.

Regardless of the extent of the testing program which a given invention may have received, a thorough knowledge of the prior art will be invaluable in deciding how to present the invention in a formal application. If the state of the art is not already well known, it will nearly always prove beneficial to make a preliminary search

There is no objection to applications based on theoretical reasoning.

for related developments. A study of the pertinent published literature will always prove rewarding both in suggesting lines of further research and in indicating where the emphasis should be placed in the patent application. Forewarned is forearmed, and if an application is so written as to focus attention on the elements of the invention not suggested by the prior art, it will be much easier to convince the patent examiner that invention exists. Here the inventor's knowledge of the past can be of considerable assistance to the patent solicitor.

## Nature of Patent Applications

The essential parts of a patent application are the specification (description of invention and claims), drawings, when appropriate, and the oath and petition. These will be described in inverse order. The oath and petition, which usually includes also the appointment of the attorney to represent the inventor before the Patent Office, is in prescribed form. This consists essentially of a sworn statement by the inventor that he has read the specification and that he believes himself to be the first inventor of the claimed invention. That he may turn out not to be the first inventor casts no reflection upon the veracity of the inventor if he verily has believed otherwise. The form must be signed by the inventor and sworn to before a notary public and is attached to the end of the specification.

Drawings are required whenever the case admits of their use, i.e., when the invention involves mechanical elements or structural details. They should be used in other cases whenever they will contribute to a better understanding of the invention. Thus flow diagrams and graphs are frequently used to good effect in chemical process and composition applications. As many figures should be provided as are necessary to show all claimed elements of the invention and to illustrate whatever alternative embodiments there are. Thus, when the invention consists of an improved element of an old machine, the element should be shown by itself in one view and positioned in the machine in another. There is considerable latitude in selection of drawings and it is always preferable to over-illustrate than to under-illustrate.

## Heart of the Patent Application

The heart of the patent application is the specification; and the claims are its teeth. Otherwise stated, the body of the specification is the description of the invention and the claims define the invention, each claim consisting of but a single sentence. The one-sentence requirement for claims often results in extraordinary grammatical construction and abnormal length but does provide reasonably exact definition of what is inventive.

The specification must contain a complete description of the invention in such clear and concise terms that anyone skilled in the art will be able to understand and make use of it. It is enough that the information disclosed be sufficient to make the invention operable in competent hands. All of the data and know-how accumulated need not be included. Hence the issuance of a patent will not necessarily entail sacrifice of trade secrets and operational gimmicks by which a resourceful organization may outperform a competitor. However, enough explicit information must be included to demonstrate operability of the invention and, if there are several possible alternative embodiments, operability of a representative number of them should be described.

The Patent Office is very exacting in its requirement that broad grouping of a number of diverse species be well substantiated. For example, if it is claimed that a broadly defined chemical composition which includes a large number of species of compound in its definition will be operative for an indicated purpose, examples must be included to show that a number of such species are equivalent in function.

Then there is the problem of the critical range. The sole reason for patentability may be the use of a critical amount of water in a pelleting process, of a critical amount of a certain chemical for a better product, of an oil having a critical range of specifications for an improved carbon black process, etc. Criticality must be well documented by experimental or calculated data before the Patent Office will accept it.

## Think Before Filing, Not After

We return again to the descriptive portion of the patent specification. This must contain everything necessary to substantiate what it is desired to claim. A description of the invention can leave nothing to the imagination, although exercise of the imagination may be necessary to provide a sufficiently complete description to justify the desired claims. It must never be forgotten that nothing can be claimed which is not in the specification as filed,

and nothing new can be added to the specification once the application is filed. So it is important that the inventor do his thinking before the application is filed.

Finally, the specification must conclude with one or more claims particularly pointing out and distinctly claiming that which the inventor regards as his invention. It is the claims and the claims alone which delimit the inventor's exclusive domain. Regardless of the extent of the description of invention, the scope of the patent thereon is no greater than that of its claims; everything else is open to the public.

Ordinarily, several claims progressively graded in breadth are employed. In this way, it is possible to reserve rights to specific embodiments and intermediate ranges of the invention in case the broader claims are ever invalidated or disclaimed. Also, additional claims are often used simply as an alternative method of defining the invention. The wording of the claims is all important and the meaning must be clear and definite. Thus, it is common practice to employ in the claims only language found in the specification and to fix the exact meaning of all key words and expressions ambiguous in context by providing definitions in the specification.

## Writing the Application

It is one function of the descriptive portion of the specification to sell the invention. The Patent Office examiner, and perhaps others engaged in the industry, must be convinced that the invention is new, useful, and unobvious, and therefore patentable. As our technology has expanded, the base on which to build new inventions has, of course, grown tremendously.

Yet at the same time the available field for invention is reduced in scope and there is spawned a proliferation of small advances in all the many ramifications of a given art. The problem of distinguishing one such advance from another has thus grown more difficult. For this reason there has been a steady increase in the average length and complexity of our patent specifications over the years. Whereas in the early years a specification seldom covered more than one printed page, today a single page specification is a rarity. One page of description and discussion is no longer sufficient to explain and sell an invention.

Most patent specifications follow a well established form. The opening paragraph contains a statement of the general field of subject matter to which the invention pertains. Next the previous state of the art is discussed in such a way as to emphasize the specific deficiencies and disadvantages which the present invention is designed to overcome. This is followed by a brief and sweeping statement of the principal objects and advantages of the subject invention.

After disposing of the generalities, attention is focused strictly on the applicant's contribution. First comes a concise statement of the invention in simplified form without including the various possible limitations, modifications and alternatives. This is followed by the detailed description which must be absolutely complete as regards the essential elements of the subject invention. Often the construction of an apparatus and operation of a process is first explained in connection with the drawings, or with reference to a specific illustrative embodiment. A generic characterization follows by which alternatives or a number of species are included within the proper scope of the invention.

Examples may be interspersed throughout the description or concentrated at the end of it. The number of examples used depends upon the complexity of the invention and the number of alternatives or species sought to be claimed. The specification then usually terminates with a general statement of utility, which is followed by the claims in sufficient number to button up the invention.

It is well to remember that while passages may be deleted from an application after it is filed, new matter can never be introduced. On the other hand, an overly long specification can divert attention from the real invention, so that all necessary description and explanation—as of elements or steps that are conventional—should be avoided. Nevertheless, even at the risk of prolixity, everything necessary to describe an invention properly in the environment in which it is used should be included. Also, it is important in pointing out the applications of the invention to include such background material as may be necessary or desirable to justify claiming all known possible equivalents.

## Patent Prosecution

In the preceding paragraphs the patent application was described. What happens to that application when it reaches the Patent Office will now be discussed and illustrated by the history of prosecution of the application of Bray, Gabry and Wendell, which ultimately became U. S. Patent No. 2,420,810.

A preliminary search for related developments is always beneficial.

When a patent application reaches the Patent Office, it is stamped with the date of receipt and given a serial number identifying the application and indicating the order in which it was received. Thus, among applications filed on the same date, priority of filing is accorded to that having the lowest number. The application is then sent to the Classification Division where the claims are studied to determine the category of science to which

the invention relates. From the Classification Division the application is then routed to the one of the 73 examining divisions having jurisdiction over the designated classification. The application is finally assigned to the examiner in that division who specializes in the particular art covered by the application.

Now, after a delay of some six to twelve months, the

It is always preferable to over-illustrate than to under-illustrate.

examiner reaches the application, and this is a summary of what he sees:

PROCESS FOR THE MANUFACTURE OF HIGH VOLATILE CARBON BLACK

This invention relates to improvements in processes of treating carbon black whereby certain selected characteristics may be imparted to it, and includes within its scope an improved carbon black of higher volatile content than has ever been known, and also a novel process for producing such carbon black.

Then comes a discussion of the defects of previous products and processes for treating blacks followed by a statement of the principal object of this invention, which is to produce carbon black having a volatile content above 12 per cent, a moderate surface area not over 400 square meters per gram, little or no thixotropy and long flow characteristics.

The invention is typically claimed thusly:

(1) A process for the production of carbon black having substantial volatile content, which comprises the steps of contacting carbon black of commerce with nitric acid, and then removing free nitric acid from the treated carbon black.

(2) A process for the production of carbon black having substantial volatile content, which comprises the step of passing nitric acid vapor through a mass of carbon black of commerce, and then removing free nitric acid vapor from the treated carbon black.

(8) A process for the production of high volatile carbon black which comprises placing carbon black of commerce in contact with hot vapors of nitric acid and oxides of nitrogen, and then flushing the treated carbon black to remove free vapors.

(10) An improved carbon black made by the process of claim 1 and having substantial volatile content, an intense black color, long flow and surface area of less than 200 square meters per gram.

(15) A process for the production of carbon black having substantial volatile content, which comprises passing heated vapor of nitric acid through a mass of heated carbon black, and simultaneously agitating the mass.

## Procedure of the Examiner

Having read the specification and studied the claims, the examiner makes a search through the collections of patents and other publications filed according to their classifications, with the starting point being, of course, the class in which the application was originally placed. He selects the publications which seem most closely related to the claimed invention and writes an "office action" as follows:

UNITED STATES PATENT OFFICE

Richard I. Bray et al

Kenway and Witter
80 Federal Street
Boston, Mass.

Ser. No. 423,512

Filed Dec. 18, 1941

High Volatile Carbon Black and the Process of its Manufacture.

Mailed: June 4, 1942.

The application has been examined.

References cited:

| | | |
|---|---|---|
| Morrell | 1,989,107 | Jan. 29, 1935 |
| "Carbon Black" pages 4-6 Copy in Div. 59 | Reprint from Ind. & Eng. Chem. | |
| Cheney | 1,497,543 | June 10, 1923 |
| Oberle | 1,632,845 | June 21, 1927 |
| Damon | 2,005,022 | June 18, 1935 |
| Aylsworth | 1,191,383 | June 18, 1916 |

"Acetylene Carbon Black" Article in Can. Chem. & Metallurgy, Vol. 17, pages 93-95

Page 3, line 25, "may be" should be changed to *is*.
Page 8, line 23, "just" should be changed to *first*.

Claims 1, 2, and 8 are rejected as indefinite due to the use of the clause "carbon black of commerce." The phrase "of commerce" implies some limitation over the usual carbon black but the intended restriction is indefinite and imparts no patentability to the claims.

Claims 10 to 14 and 18 are rejected as informal because they claim an article by the method of making it. Such claims are improper in accordance with the doctrine of *Ex parte Fessenmeier* 1922 C. D. 18; 302 O. G. 199.

Claim 1 is rejected as fully met by Oberle. See page 2, lines 8-35 of this patent.

Claims 2 to 9 and 15 to 17 are rejected as unpatentable over Damon in view of Aylsworth. Damon discloses treating carbon black with air at temperatures of about 300 to 500°F. while Aylsworth discloses the use of liquid $HNO_3$ to oxidize graphite. The substitution of vapors of nitric acid for the air used by Damon might possibly effect a greater degree of oxidation, but this result is merely the one to be expected in view of the greater oxidizing power of nitric acid. Flushing with air is considered to be an obvious method of removing the excess $HNO_3$.

Claims 10 to 14 and 18 are rejected as substantially met by Damon. The patent is thought to meet the claims except as to perhaps the amount of volatile matter specified in claim 14, and it is not clear that this involves more than a difference in degree

## Test Your Patent I.Q.

1. The number of patents issued in this country every year is, approximately

(a) 7,000. (b) 70,000. (c) 170,000. (d) 17,000.

2. The life of a U. S. patent is

(a) 17 years from date of issue.
(b) forever from date of application.
(c) as long as periodic fees are paid.
(d) 10 years from date of issue.

3. A patent specification must include only

(a) the title of the invention.
(b) sufficient information for classification as to subject matter.
(c) name of the inventor and title and date of the invention.
(d) sufficient information to enable anyone skilled in the art to practice the invention.

4. Of the several events which can determine priority of invention, the one which is of greatest importance generally is

(a) conception of the idea.
(b) first written disclosure.
(c) reduction to practice.
(d) filing of a patent application.

5. In this country the prosecution of an average patent requires about

(a) 4 years. (b) 4 months. (c) 6 years. (d) 1 year.

6. The scope of protection afforded by a patent is determined mostly by the language used in

(a) the title of invention.
(b) the claims.
(c) the oath and petition.
(d) the descriptive portion of the specification.

Check your score on page 470.

since apparently a volatile content of the amount specified could be obtained by sufficiently prolonged treatment with air. As to the wettability of carbon black, see the article in *Canadian Chemistry and Metallurgy*, which states that certain types of carbon blacks, including the impingement type, are readily wetted by water. Damon's treatment is obviously applicable to any type of carbon black, including the impingement type, and when such a black was subjected to Damon's process a wettable carbon black would necessarily be obtained.

*Examiner*

### Reply by the Patent Attorney

After due study of the office action and publications (references) cited, the patent attorney replies as follows:

Amendment B

Richard I. Bray et al
Ser. No. 423,512
Filed December 18, 1941
High Volatile Carbon Black and the Process
of its Manufacture.
Hon. Commissioner of Patents,
Washington, D. C.
Sir:

In response to the Office Action of June 4, 1942, please amend the above-entitled application as follows:

Page 8, line 23, change "just" to —first—

Claims 1, 2 and 3, line 2, after "content," insert—relatively low surface area and long flow—

Claim 1, line 3, cancel "of commerce"—

Claims 8 and 9, line 2, after "black" insert—having relatively low surface area and long flow—

Line 2 of both claims, cancel "of commerce" and insert—in a dry state—

Claim 15, line 2, after "content," insert—relatively low surface area and long flow—

REMARKS

The term "of commerce" has been removed from claims 1, 2, 8 and 9. What applicants had in mind was carbon black as a commercial article, not necessarily c. p.

Claim 1 has been amended to distinguish more clearly from the Oberle patent, which does not treat carbon black at all. The specification of the patent says,—

> "As a raw material I prefer a carbon obtained from hydrocarbons, especially mineral oils or other derivatives, that is carbonaceous material, petroleum coke or free carbon filtered residual substances, as disintegrated or pulverized in a ball mill . . . . . "

and this product is defined page 1, line 29 as

> "somewhat graphitic in its nature, but is not of such a bulky character that it cannot be readily molded by the addition of an adhesive substance."

This product Oberle molds into carbon pencils for arc lights or dynamo brushes. Applicants on the other hand are dealing with carbon black having a high volatile content—not at all graphitic, but useful in explosives, inks, etc. It has an intense black color and an astonishing flow, all qualities quite beyond the contemplation of Oberle's patent.

Claims 2 to 9 and 15 and 18 have been amended to distinguish more clearly from Damon in view of Aylsworth. Aylsworth deals not with carbon black, but with graphite. He treats flaked graphite with nitric acid and brings about a physical change increasing the volume of the graphite about 25 times. There is no possible logical combination that can be made between Aylsworth's process of making expanded graphite and Damon's process of improving carbon black. The disclosure of the Damon patent is discussed in the present application, page 2, last paragraph, wherein is pointed out the advance of the present invention over any suggestion of Damon.

Favorable reconsideration of claims 10 to 14 and 18 is requested. These claims are fully warranted by the decision *Ex parte Fessenmeier* 1922 C.D. 18, in which the concluding paragraph is as follows:

> "The applicant has stated he is unable to define his product by any other means than by the steps of the process of producing. The examiner has suggested no other way, and I am unable to add anything by way of suggestion. It is thought, therefore, that the claims should be allowed in their present form."

In the present case applicants are unable to define their novel product by any other means than the steps of the process producing it. If the examiner can suggest no other way, the present claims would seem to be exactly in line with what Mr. Commissioner Kinan approved in the *Fessenmeier* case. Allowance of these claims and the application as now presented is requested.

Respectfully submitted,
*Attorney for Richard I. Bray et al*

Boston, Mass.
September 28, 1942

In due course another office action answering the arguments presented by the attorney and repeating the rejection on Damon in view of Aylsworth is issued. As the other references are not discussed it is assumed that the examiner is not relying upon them as grounds for rejecting the claims.

This action is answered by the attorney by an amendment cancelling all of the claims then in the case and substituting new claims of which the following are typical:

(21) A process for the production of carbon black having a volatile content in excess of 12%, a surface area below 400 square meters per gram of carbon black and long flow characteristics, which comprises the steps of passing a hot mixture of nitric acid vapor and air through a mass of carbon black heated at least to 200° F. and not over 400° F., and then removing free nitric acid vapor from the treated mass.

(28) An improved carbon black having a volatile content in excess of 12%, an intense black color, long flow characteristics, and a surface area of not less than 200 square meters per gram of carbon black.

It should be noted here that the new claims contain the substance of the old claims which were cancelled. Rewriting claims is just one way of amending old claims without excessive interlineation.

The office action in response to the amendment was as follows:

UNITED STATES PATENT OFFICE

Kenway & Witter
80 Federal Street
Boston, Mass.

Applicant: Richard I. Bray, et al
Ser. No. 423,512
Filed Dec. 18, 1941
For High Volatile Carbon Black and the Process of its Manufacture

Mailed: U.S. Patent Office
April 5, 1944

Responsive to the amendments filed October 15 and October 16, 1943.

Additional reference:

| | | | |
|---|---|---|---|
| Fuchs | 2,312,707 | Mar. 2, 1943 | 23-209.1 |

The amendment directed to page 3, line 11, has been entered on page 2, same line. The source of the subject matter thus inserted should be identified and the inserted matter shown not to be new subject matter. Pending such showing cancellation is required.

Page 3, line 9, the subject matter inserted in that line constitutes new subject matter and cancellation is required. No disclosure of the particular surface area there disclosed is found in the original specification.

Claims 19 to 27 are rejected as based on subject matter not previously described or shown because of the limitation to a surface area of less than 400 square meters per gram.

Claim 35* is rejected as an improper article claim for the reasons of record.

Claims 28 to 32 and 35, the article claims, are again rejected as indefinite for the reasons of record. While applicant has clarified the meaning of these terms somewhat by his argument and amendments, they are still considered as too indefinite to define over the art. The term volatile content as now defined is perhaps the most definite but it still does not tell what the constituents of the volatile content would be. According to the analysis given on page 2, the volatile content is mainly CO and $CO_2$, but other constituents such as hydrogen and hydrocarbons are present and applicants' recited volatile content might consist mainly of hydrocarbons in which case it would not be distinguished from powdered coal. The other terms are obviously relative only and do not distinguish from the cited art.

* Which claims the product by the process of its manufacture as in the case of old claim 10.

Claims 28 to 32 and 35 are rejected as substantially met by Damon for the reasons of record. The evidence presented by applicant as to the character of his product is not convincing since he does not describe the tests by which the properties recited in the claims were determined. No analysis of the volatile content is given, nor indeed is any example given of a carbon black having a specific volatile content; there is merely a statement that carbon blacks of as high as 30 to 60% carbon black have been produced. The volatile content is capable of being very accurately analyzed as shown by the insertion made by applicant on page 2, line 8 of the specification, and no reason is seen why such an analysis should not be given in order to furnish further evidence of the difference alleged over the prior art.

Moreover the results obtained are inconsistent; applicant obtains greatly increased volatile content without increasing the surface area, whereas generally the reverse is true.

Claims 28 to 32 and 35 are also rejected as substantially met by Fuchs who discloses heating coal substance in air to form carbon black. See page 2, column 2, lines 11 to 15. While Fuchs does not disclose grinding the coal substance, this would be an obvious and essential step in the conversion of the coal to carbon black.

Claims 19 to 27, 33 and 34 are rejected as lacking invention over Damon or as unpatentable over Damon in view of Aylsworth for the reasons of record and as above stated with respect to the article claims. The specification is not convincing as to the alleged novel qualities produced in the product and accordingly the claims are considered to involve merely the use of an equivalent oxidizing agent in the process of Damon.

This rejection is made FINAL. While a new reference has been cited and claims rejected thereon, this rejection is considered to be the same as set forth in the last paragraph of page 1 of the last Office action.

*Examiner*

The action was made final, which is a ruling by the examiner that an issue has been reached. Thus prosecution before the primary examiner is closed and the applicants must then appeal to the Patent Office Board of Appeals, which was done.

There are in fact various informal steps that can be taken after a final rejection and before appeal, such as filing affidavits and interviewing the examiner. These will be discussed in the next part of this series in conjunction with appeals and other special phases of patent prosecution.

It must always be borne in mind that the claims and only the claims determine the field of search and constitute the subject matter of the contest between examiner and attorney. The description of the invention is the framework to which the claims are attached but is not itself in issue. Consequently, if the procedure illustrated above is understood by the inventor, he will be well equipped to decide when he has made an invention and how he should describe and explain it to his attorney.

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**Answers to Patent I.Q. Test**

1. (b) 70,000.
2. (a) 17 years from date of issue.
3. (d) sufficient information to enable anyone skilled in the art to practice the invention.
4. (c) reduction to practice.
5. (a) four years.
6. (b) the claims.

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**Next Month: Part 3—Value of the Patent**

Panelists at the Southern Ohio Rubber Group meeting were, left to right, John W. Snyder, F. W. Gage, Ralph F. Wolf and Merton L. Studebaker.

# Carbon Black and Silica

***Reinforcing agents for rubber was the subject of the day at the spring technical meeting of the Southern Ohio Rubber Group***

THE topic of the panel discussion at the spring technical meeting of the Southern Ohio Rubber Group on March 28 was "Reinforcing Agents for Rubber —Carbon Black and Silica." About 100 members were in attendance at the meeting, which was held at the Engineers' Club in Dayton.

Moderator of the panel was F. W. Gage (Dayton Chemical Products Laboratories). The participating members were John W. Snyder (Columbian Carbon Co.), who talked on "Carbon Blacks — The Channel, SRF and FEF Blacks;" Merton L. Studebaker (Phillips Chemical Co.), who had as his subject, "Carbon Blacks —The HAF, ISAF and SAF Blacks," and Ralph F. Wolf (Columbia-Southern Chemical Corp.), who discussed "Silicas."

Serving with Mr. Gage, chairman of the meeting, were Stanley S. Pomeranz (Vernay Laboratories); George Lang (Premier Rubber Co.); Dayle Buchanan (Inland Manufacturing Division), and Charles G. Wyman (Dayton Rubber Co.). The talks of the speakers follow:

## Carbon Black—The Channel, SRF and FEF Blacks

By JOHN W. SNYDER
*Columbian Carbon Co., New York, N. Y.*

THOUGH the carbon black industry started in the 1880's, the first big volume application of the material came in 1912 with the discovery that it would reinforce rubber and thereby greatly improve the mileage of tires. The first work in this country was done with what is now termed channel black. In the early 1920's there came into the picture a black made by a furnace process which did not reinforce as well as channel black but did fulfill many of the requirements for certain types of rubber compounding. This particular black has come to be known as Semi-Reinforcing Furnace (SRF) Black. Following that there came into being the so-called thermal carbon, and more recently, the modern type furnace blacks made either from gas or oil. While it is not the intent here to go into great detail on the manufacturing processes, it is necessary at least to outline these methods in order better to grasp the reasons for some of these different characteristics of the carbon blacks.

As mentioned, there is one type of carbon known to the trade as thermal black. This perhaps is an unfortunate choice of terms in that strictly speaking all carbon blacks are thermal blacks. If we look at the cross section of a flame used for the manufacture of channel blacks, we can readily pick out the three portions of that flame that are common to the candle flame studied in high school and college chemistry.

First there is the outer blue sheath of burning gas or fuel which creates the heat for the thermal cracking of

gas issuing from the tip and which is enfolded inside of this hot burning outer layer. In the center of the flame at the very bottom is seen the black area which is the raw gas issuing from the tip. In between this black area and the blue sheath there is the luminescent region in which the raw gas or fuel is subjected to thermal cracking from the heat generated in the outer sheath. This cracking produces carbon which at the temperature of the flame glows and gives the yellow or reddish appearance.

### Production of Channel Black

If we insert into this flame a cool surface, we will obtain a deposit of carbon which can be scraped off and collected. This process is very much the same as the one used to smoke a glass with a candle flame in order to look at the sun. In the case of a channel black manufacturing operation, the carbon while on the collecting surface is subjected to oxidizing conditions. The supply of air, while incomplete for perfect combustion, must be maintained at a certain level in order to keep the flame burning. This means that in the products of combustion there will be a certain amount of oxygen present. The gases bathe the carbon on the channel iron, and since the temperature is still above the reacting level, oxygen will be picked up by the carbon. This oxygen is chemically combined in the form which we call a CxOy complex. This is what accounts for the low pH of channel blacks. The higher the oxygen content of a carbon, the lower is the pH.

In turn, the low pH has a marked effect on vulcanization characteristics. While in the absence of an accelerator carbon black might be called a speeder up of vulcanization, it is a retarder of vulcanization when accelerators are present. This effect has been found to be correlated with the ability of carbon black to adsorb materials from solution. A typical test is one known as DPG Adsorption, by which the amount of DPG (diphenylguanidine) adsorped by the particular grade of carbon black can be measured. It has been found that the higher the adsorption effect, the greater is the retarding effect. In turn it has been found that the higher the oxygen content, or the lower the pH, the greater is the adsorption activity and thus the greater the retarding effect on normal rubber compounds containing accelerators.

### Producing SRF Black

If the flame is left free and the carbon collected from the smoke of this free flame, we then produce a somewhat different type of product. Now it is possible to control the reaction so that the carbon is produced under reducing conditions. Consequently there is no oxygen reaction, and we have essentially pure carbon. This is the condition under which the furnace black, SRF, is produced. The flame instead of being the tiny bat wing flame of the channel process is quite a bit larger. Several of these flames project into one large size furnace. The control of air and gas can be very carefully regulated and as a result smoke can be produced and this collected by a series of steps, including an electrical precipitator, cyclones, and bag filters.

Examination of this carbon shows that it is low in oxygen content and is high in pH. Whereas the channel carbons would have pH values in the range of 4 to 5, the SRF type of carbon made by this furnace process will show a pH in the range of 9 to 10. Thus we see that the oxygen content or pH of a carbon black is controlled by the oxidation or reduction conditions existing in the process of manufacture itself.

It was realized very early that the reinforcing effect of carbon black undoubtedly was due to the fineness of particle size of this mateiral, which is so fine that the microscope could not be used to determine its particle size. It was not until the electron microscope came into existence that an accurate visual picture of carbon black could be obtained. We now know that the channel blacks cover a particle size range of 26 to 30 millimicrons.

As opposed to this extremely fine particle size, the SRF carbon with a particle size in the range of 83 millimicrons is considered coarse. As might be expected, the channel black is a better reinforcer of rubber than is SRF. That this is recognized is evident from the meaning of SRF, which is Semi-Reinforcing Furnace. While channel black in a natural rubber compound at 50 parts loading would produce a tensile strength of 4,700 pounds per square inch, SRF would produce a tensile strength of about 3,600 pounds per square inch. The difference between these types shows up in the hardness of the rubber, with the channel blacks producing a hardness of 64 and SRF of 55.

In the 1940's oil began to be used as a raw material for carbon black manufacture and something new showed up in its properties. The blacks made from oil showed a higher modulus than blacks made from gas. It had earlier been recognized that acetylene black made from acetylene, which contains triple bonds of carbon, gave extremely high modulus values. Again, the electron microscope came to the rescue, and it was found that these carbons, which had the unusually high modulus values, tended to exist in the form of chains rather than clusters or individual particles. This habit of chain formation we call structure. The carbons such as channel and SRF have normal structure levels and, therefore, any carbon having a higher structure level would be called high structure, and any carbon having a lower structure would be called low structure. An example of the low structure carbons is the thermal black.

### FEF Blacks

In this discussion the carbon made from oil is the grade known as FEF. Its particle size is intermediate between channel black and SRF and, as might be expected, its tensile strength is also intermediate. However, when we come to the matter of modulus, we find a completely different story. In a natural rubber compound channel black would show a 300 per cent modulus of 1,500 pounds per square inch; SRF, 1,450 pounds per square inch, and high structure FEF, 2,000 pounds per square inch. Since this carbon is made by a furnace process, the pH also is high as compared to the low pH of channel black.

The importance of structure is not solely that of increasing modulus. Structure influences the ability to produce raw stocks which extrude smoothly and which conform very closely to the cross section of the die. While this is not so important with natural rubber, it is of vital importance in many types of extruded goods if

such synthetics as either GR-S type or butyl rubber are used. Thus FEF, which actually brings into its name the extrusion characteristics (Fast Extrusion Furnace), finds its primary application in the extruded goods field, including window channeling and inner tubes.

As is so often the case, desirable properties in one direction are accompanied by undesirable properties in another direction. The effect of carbon blacks on heat buildup in rubber compounds during flexing is rather pronounced. The finer the black, the greater is this heat generation. For example, in the same natural rubber compounds channel blacks would increase in temperature 60 degrees in a certain flexing test, whereas SRF would increase only 37 degrees. While channel black produces excellent wear, it is not desirable if high heat buildup is not wanted and if abrasion resistance is not important. Thus in building a tire, channel black would be used in the tread for good abrasion resistance and SRF would be used in the carcass stocks, particularly inner plies of both passenger and truck tires, where low heat buildup is very important.

FEF, with somewhat better reinforcing characteristics than SRF and heat buildup characteristics intermediate between channel and SRF, is today a popular carbon for the carcass stocks of passenger tires. As opposed to the 60 degree rise of channel black, FEF shows 46. While this is higher than the 37 of SRF, the better reinforcing characteristics of the FEF more than counterbalance this somewhat higher heat buildup for certain application.

While today the fine particle size reinforcing furnace blacks have displaced channel black for use in the treads of many tires, there are still certain tread applications where channel black is preferable. This preference is based on the fact that the channel black is a retarder of vulcanization. It has been found that in the very large size tires channel black is to be preferred because it does not cause the tread to cure up too fast. In other words, it is possible to compound a thick tread which will not over-cure on the outside before the heat has gotten all the way into the inside. This tendency of slower cure also shows up in a lesser tendency to scorch, so wherever a compound is likely to scorch, it is desirable to consider a channel black. In fact, there are some applications where channel black is used as a blend with some of the furnace blacks in order to slow down the rate of cure.

Electrical conductivity of rubber compounds has become rather important. Conductivity is a function of three variables in carbon black—the finer the particle size, the better the conductivity; the higher the structure, the better the conductivity; the lower the oxygen content, the better the conductivity. The fine particle size furnace blacks of high structure and low oxygen content are best for conductivity. On the other hand, channel black with its normal structure and higher oxygen content is a better producer of insulation. Thus in certain wire jackets where insulation resistance is of prime importance, channel black is still preferred.

An attempt has been made to outline the properties of the three types of carbons in the hope that from a knowledge of the properties, the individual rubber compounder will be able to select the one best suited for the properties desired in his product.

# Carbon Black—The HAF, ISAF and SAF Blacks

By MERTON STUDEBAKER

*Phillips Chemical Co., Akron, Ohio*

THE carbon blacks of the types FEF (fast extrusion furnace black), HAF (high abrasion furnace black), ISAF (intermediate super abrasion furnace black) and SAF (super abrasion furnace black) are made in furnaces by incomplete combustion of oil. For reasons mainly of economy, natural gas is frequently used as an auxiliary fuel. These carbons are used almost exclusively in rubber. Their properties are important in determining both the processing characteristics of unvulcanized rubber stocks and the properties of the cured vulcanizates. Recent analyses indicate that the properties of these carbons will fall in the following ranges:

| Property | FEF | HAF | ISAF | SAF |
|---|---|---|---|---|
| Particle size (Å) | 410-580 | 260-350 | 225-275 | 180-270 |
| Surface area ($m^2/g$) (Nitrogen absorption) | 36-48 | 62-88 | 95-138 | 120-145 |
| Hydrogen content | 0.30-0.39% | 0.27-0.34% | 0.20-0.32% | 0.28-0.34% |
| Oxygen content | .15-.55% | .45-.8% | 1.0-1.6% | 1.3-2.0% |
| Oil absorption (cc/g) | 1.1-1.4 | 1.2-1.4 | 1.2-1.6 | 1.2-1.6 |

## Characteristics of the Stocks

In general, it can be said that unvulcanized rubber containing these carbons handles well in virtually all factory operations in which black stocks are used. Vulcanized stocks containing these blacks are characterized by relatively high modulus. The tensile strength generally increases with decreasing particle size. Tear resistance, abrasion resistance and hysteresis properties follow the same pattern. In general, these stocks vulcanize rapidly and have lower accelerator requirements than those made with channel blacks; and, as one might expect from this, they are more scorchy. These carbons are described as having high structure and they exhibit the good extrusion properties common to high structure blacks. They calender well at the loadings normally used, e.g., 25 phr or more. All have good hot tear and good hot tensile properties, better than those of channel blacks. The large volume use for these materials is in tires, and the HAF, ISAF and SAF blacks are used mainly in the treads. These carbons exhibit very good abrasion resistance, which is shown in the following

table, which represents the average results of road tests by Phillips Chemical Co.:

Summary of Tread Performance

| Polymer | HAF | ISAF | SAF |
|---|---|---|---|
| Natural Rubber (Passenger and truck tires) | 100 | 120 | 125 |
| Cold SB-R (passenger) | 100 | 112 | 130 |
| Oil-Extended Cold SB-R | 100 | 111 | 117 |

With the advent of the 14-inch tires, considerable interest has been shown in adopting better quality rubber compounds in the undertread, and here Philblack O and Philblack I (even Philblack A) have been used. In crude rubber, the cut and crack resistance is improved on going from HAF to ISAF and on into SAF treads; but, of course, the loadings of the carbon blacks are reduced as finer particle size carbon black is adopted. SAF treads have higher running temperature on the road, but they seem to have better abrasion and crack resistance, and the cut resistance is outstanding. In cold rubber, the results to date indicate that cracking and cutting of the treads increases as we go from HAF to ISAF and on into SAF treads. It is entirely possible that this may be eliminated by proper compounding and changes in tire construction.

### Applications of the HAF, ISAF and SAF Blacks

ISAF blacks are a natural for quality camelback and have largely replaced other carbon blacks in this use. HAF blacks have been used in both crude rubber and synthetic rubber conveyor belt covers for some time, and both ISAF and SAF are finding a place in this market. These blacks exhibit outstanding service in applications where crushed rock is dropped on the conveyor belt and in other applications where superior resistance in impact and abrasion are encountered.

In V-belts, Philblack A has been used in the core to provide good flex resistance and thermal conductivity. HAF is used in curb hose covers to provide good abrasion resistance to the nitrile or neoprene rubber stocks. It is also used for insulated wire jackets which are subjected to severe abrasion, as in cables for mining machinery.

The oil furnace blacks have been used in hard rubber to obtain faster cure and to give better control of shrinkage. In some applications, they are added to provide improved electrical conductivity to the hard rubber stocks.

A specialized application of the SAF blacks has been found in tank blocks; however, very little information is available on this service. It has been indicated to us, however, that Philblack E appears to be superior in this application.

In those gasket compounds where high modulus and low compression set are important, the oil furnace blacks have been used. Another application where high modulus and low compression set is important is in certain types of motor mounts. The high hot tensile and hot tear of HAF and SAF stocks have been utilized in high temperature applications.

There is one application of furnace black compounds in which there have been a number of complaints, and that is in applications requiring rubber-to-metal adhesion. The trouble generally seems to be that compounds were used which cured too fast. When the cure is slowed down to permit intimate contact during cure, good results have been obtained. The oil blacks have found application in footwear and in wire stocks vulcanized with C.V. cures. In these applications, channel black is not generally used because it gives a sticky surface. Frosting is also generally associated with channel black in these stocks. In these applications, furnace blacks have been found to be satisfactory, and the oil type carbon blacks have found a definite place.

### Application of FEF Blacks

Probably the outstanding application of FEF blacks has been in molded and extruded goods, and sponge. Here, the ability of the blacks to reduce the nerve of synthetic rubber and to provide smoother flowing, homogeneous stocks has been one of their important characteristics. In all of these applications where black stock can be used, it is found advantageous to start the compound with at least 20 parts of FEF or HAF, added early in the mixing, and to build the compound from this point.

In general, for molded goods it is best to follow the practice of adding a minimum of 20 parts of oil-type furnace blacks. Here, these structure blacks provide a homogeneous matrix with good flow into the mold. When compared with other types of carbon black, the oil blacks give quicker cures, both because of their direct effect upon rate of curing and their indirect effect of providing higher thermal conductivity to the stock. The stocks have better appearance. They give cleaner molds, with better aging properties and appreciable savings on accelerators. Aside from mold design and compounding to higher modulus, the only effective way to combat backrinding is to cure at lower temperatures. Here, the furnace blacks serve the double purpose of permitting the cure to take place at lower temperature and of improving the thermal conductivity and, hence, permitting the heat to get into the center of the molded piece.

For extruded goods the oil type furnace blacks are outstanding in providing smoother extrusions, glossier stocks, with relatively smaller extrusion shrinkage than channel blacks, SRF or thermal blacks. Although the FEF blacks tend to have slightly better properties in these respects, the difference between them and the HAF blacks is so small as to be negligible in many applications. The ISAF and SAF blacks also have good extrusion characteristics. Another important property of these stocks is that they hold their shape when hot better than the stock prepared with other types of carbon black.

In manufacturing sponge Philblack A and Philblack O are also used advantageously up to 20 phr during the rubber breakdown. These blacks contribute to uniformity in the stock and, of course, aid in cure.

In summary, it can be said that these carbons are used wherever quality stocks are important. They contribute both to the appearance and the serviceability of the items. For abrasion resistance, they are insurmountable; but there are many applications where these blacks are used because they contribute other desirable properties, such as good appearance, high thermal conductivity, high electrical conductivity and good over-all curing characteristics.

# Silicas

By RALPH F. WOLF

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FINE particle silicas are referred to occasionally as white carbon black, and it appears possible today that some type of fine silica may eventually give carbon black serious competition. The reinforcing silicas have, at least, opened up a new frontier in rubber chemistry in the last few years since the first precipitated, fine particle, amorphous silica became commercially available. The reinforcing silicas, such as Hi-Sil, are the best non-black reinforcing pigments ever developed and they come closest to carbon black properties of any available material. There is no fundamental physical nor physico-chemical reason why they can not be made as good as black. From the physical standpoint, they can be made of as fine particle size as rubber blacks. From the physico-chemical standpoint, silicas have extremely active surfaces and there are many things that can be done with those surfaces.

What are some of the similarities and differences between silicas and blacks? A few of these are shown in Table I. The difference in color is an obvious one. Incidentally, it is easy to color silica compounds black but you cannot color black compounds white. Silica is closer to black in its specific gravity than any other filler. Average particle size is about the same. Surface area of the silica is much higher. This seems odd, at first glance, as they both have about the same particle size, but it is explained by the fact that the silica has more internal porosity. This also explains the higher oil absorption of the silica. The HAF black is somewhat more alkaline than Hi-Sil 233, which is purposely held close to neutrality. Silica can be more alkaline, as Hi-Sil 101 (pH = 8.5), or more acid, as Hi-Sil X303 (pH = 4.7).

The difference in ash content is included to point up the fact that black is a combustible, organic material and that the fine silicas are principally inorganic material already in the oxidized state. An important difference is that black is hydrophobic and silica is hydrophilic. As far as I know, this characteristic of black can not be changed. Silicas, however, can be made hydrophobic although it is costly to do so at present.

TABLE I—SIMILARITIES AND DIFFERENCES BETWEEN CARBON BLACK AND SILICA

| | Carbon Black (HAF) | Silica (Hi-Sil 233) |
|---|---|---|
| Color | Black | White |
| Specific gravity | 1.80 | 1.95 |
| Average particle size, microns | 0.026 | 0.024 |
| B.E.T. surface area, sq.m./gm. | 75.0 | 155.0 |
| pH | 8.0 | 7.0 |
| Ash, per cent | 0.2 | 90.0 |
| Oil absorption, gms. oil/100 gms. pig. | 120.0 | 170.0 |
| Attraction for water | Hydrophobic | Hydrophilic |

Why have the reinforcing silicas only recently begun to attract much attention? The answer is that until Hi-Sil appeared, they were high-priced and unavailable except in small quantities. They were high priced either because they were made by costly, high temperature processes or because they used expensive raw materials. The pyrogenic silica, Aerosil, which is made in Germany and imported into this country and sold under the name Cab-O-Sil, is an example of the former. The so-called "white carbon black" announced by Goodrich in 1946 is an example of the latter.

In contrast to these, the Hi-Sils are made by precipitating silica from sodium silicate solution by use of common and relatively inexpensive ingredients. X-ray diffraction studies show that they are completely amorphous and contain none of the crystalline varieties of silica. In this respect they differ markedly from the hard, glassy, crystalline silica gels which are precipitated by ordinary acidification of sodium silicate solutions.

Reinforcing silica, such as Hi-Sil, is easily mixed and dispersion of the pigment is excellent. It is not necessary to masterbatch. It is better to mix silica batches in a Banbury than on a roll mill. No special precautions need to be taken for Banbury mixing; procedures ordinarily used for other reinforcing fillers should be followed.

## Mill Mixing in Natural Rubber

No problems are encountered in mill mixing Hi-Sil into synthetic rubber but, unless properly done, mill mixing may result in failure to obtain expected properties from natural rubber compounds loaded with it. This appears to be due to degradation from excessive mixing. Silica disperses readily. Some compounders expect difficult dispersion because of its fine particle size and they employ long mixes or a remilling procedure. No harm is done if this mixing is done in a Banbury. If done on a roll mill or if the batch is remilled excessively beyond the time needed to work in sulfur and accelerators, the results are harmful.

Loss of properties can be minimized in two ways: (1) If a roll mill is used, mix the complete batch and cut from the mill as quickly as possible, or (2) Mix the rubber and silica only, omitting all softeners, fatty acids, accelerators or other materials that might be adsorbed by the silica. After this rubber-pigment mixture has been aged for a day, it can be finished on a roll mill without special precautions and there will be no loss of properties. This procedure differs from masterbatching as the term is commonly understood since all oils and readily adsorbed materials must be excluded. In ordinary masterbatching the softener is generally added with the pigment to improve dispersion. If a silica masterbatch is prepared by the latter method, with softener, the final mix will have to be made as quickly as possible to avoid loss of properties.

The reason for this behavior of silica stocks is not

TABLE II—EFFECT OF HI-SIL 233 ON PLASTICITY OF NATURAL RUBBER

| Volumes of Hi-Sil 233 per 100 parts of natural rubber* | Mooney plasticity (Large rotor, 4 minutes at 212°F.) |
|---|---|
| 0 | 25 |
| 10 | 40 |
| 15 | 65 |
| 20 | 105 |
| 25 | 143 |
| 30 | 202 |

* Smoked sheets given 10 minute breakdowns on a mill with intervening 30 minute rest periods. All batches were mixed for 12 minutes in a Banbury.

clearly understood. It is believed that when there are no other materials present to be adsorbed by the pigment, the rubber penetrates into the pigment flocs. Subsequent addition of materials that are more readily adsorbed by the pigment does not then interfere with any existing rubber-pigment bond. If softener is added to the rubber at about the same time as the silica, it may be adsorbed preferentially and block the rubber away from the pigment surface. The more vigorous and prolonged action of a roll mill seems to aggravate this condition more than the faster but less thorough mixing of the Banbury.

## Effects on Viscosity

Reinforcing silicas stiffen rubber compounds to a considerable extent. Table II shows the Mooney plasticities of natural rubber batches containing various loadings of Hi-Sil 233.

Since Hi-Sil will be most frequently used in white or non-black colored stocks, the plasticizing effect of softeners which are relatively non-discoloring is of more interest than that of dark colored or staining softeners, resins, tars or pitches. Table III shows the Mooney plasticities produced by a representative group of such softeners on natural rubber loaded with 25 volumes of Hi-Sil 233. Several typical fatty acids were included to see if there would be any choice among them as far as softening power is concerned. All seemed to be about equally effective.

It is interesting to note that the best softeners are those of vegetable origin. Fortex is a vegetable acid material; Liqro is tall oil; Plastone is based on rosin, and rosin oil itself is very effective. The chemical plasticizers are less effective although better than petroleum based materials, which appear to be of little value.

Reinforcing silicas are very adsorptive. Therefore, in formulating natural rubber compounds containing them it is necessary to use more than the ordinary amount of accelerator or else employ certain activators. Hi-Sil compounds vulcanize very slowly when compounded with what would ordinarily be considered normal acceleration. For example, a 30 volume stock might require two hours to cure with a single accelerator such as 1.5 parts of a guanidine, one part of an aldehyde-amine or thiazole, or 0.5 part of a thiuram or dithiocarbamate.

Reduction of cure time is achieved with combinations of primary and secondary accelerators. Results obtained with a combination of 1 part of a thiazole and 0.5 part of a thiuram in natural rubber loaded with 30 volumes of Hi-Sil 233 are shown in Table IV.

Thiazole-thiuram combinations were used in the early production of rubber goods loaded with Hi-Sil 101. This combination was inadequate because the compounds were scorchy and not flat curing. Later, more satisfactory cures were obtained with thiazole-guanidine combinations such as the one shown in Table V.

In early work with Hi-Sil back in 1948, only one part of fatty acid was used in natural rubber stocks containing 30 volumes of pigment. Much of the natural rubber available then was quite poor. In some cases, one part of stearic was not enough because the rubber was deficient in natural fatty acid and was starved by the adsorptive pigment. This sometimes caused low tensile and tear strength and for this reason we began using three parts of fatty acid in compounds containing large amounts of reinforcing silica. Poor quality of rubber is no longer a problem and, since excess stearic acid will retard some accelerators, we suggest holding the fatty acid content in the range of one to three parts.

Any of the non-staining antioxidants are satisfactory with Hi-Sil except where a dead white is desired. In the latter case, more care must be exercised because reactions occur between reinforcing silicas and certain antioxidants which produce tints that are very faint but still noticeable in dead whites. For example, Agerites White and Alba, Aminox and Stabilite Alba produce definite tints. Good non-staining antioxidants to use with the Hi-Sils are 425 and 2246, Agerite Gel or Stalite, Flectol H, Deenax, Ionol, Santowhite Powder or Wingstay S. Excellent retention of properties and good resistance to the deteriorating effects of aging are shown by silica compounds containing any of these antioxidants.

TABLE III—PLASTICIZING EFFECT OF VARIOUS SOFTENERS ON NATURAL RUBBER LOADED WITH 25 VOLUMES HI-SIL 233

| Softener | Mooney Plasticity (ML 4 at 100°C.) 3 parts softener phr | 5 parts softener phr | 10 parts softener phr |
|---|---|---|---|
| Fortex | — | 70 | 45 |
| Liquid Plastone | — | 65 | 37 |
| Liqro | — | 78 | 53 |
| Rosin Oil | — | 85 | 49 |
| Stearic Acid | 108 | 86 | — |
| Lauric Acid | 109 | 85 | — |
| Oleic Acid | 110 | 90 | — |
| Cottonseed F.A. | 115 | 88 | — |
| HSC 13 | — | 86 | 49 |
| Wool Grease | — | 85 | 51 |
| Palm Oil | 114 | 100 | — |
| RPA #3* | — | 102 | 89 |
| Peptone 22* | — | 101 | 92 |
| 10°C. m.p. Coumarone | — | 108 | 85 |
| Sundex 53 | — | 110 | 88 |
| Circosol 2XH | — | 109 | 95 |
| Petrolatum | — | 112 | 90 |
| Forum 40 | — | 112 | 94 |
| Dipolymer Oil | — | 114 | 96 |
| Circo Light | — | 114 | 95 |
| Bondogen | — | 128 | 118 |
| No Softener | — | 138 | — |

* 0.5 and 1.0 part used instead of 5 and 10. These mixes were made at 225° to 240°F.

TABLE IV—VULCANIZATION OF 30 VOLUME HI-SIL 233 STOCK WITH THIAZOLE-THIURAM COMBINATION

Formula

| | |
|---|---|
| #1 Smoked Sheets | 100.0 |
| Zinc oxide | 5.0 |
| Hi-Sil 233 | 58.5 |
| Antiox. 2246 | 1.0 |
| Sulfur | 3.0 |
| MBTS | 1.0 |
| Me. Tuads | 0.5 |
| Triethanol amine | 2.0 |
| Stearic Acid | 3.0 |

| Mins. Cure 287° | Modulus 300% E. | Tensile | Elongation | Duro Hard | Tear lbs./in. |
|---|---|---|---|---|---|
| 10 | 1180 | 3740 | 590 | 70 | 810 |
| 15 | 1210 | 3750 | 590 | 71 | 740 |
| 30 | 1190 | 3520 | 580 | 74 | 740 |
| 45 | 1140 | 3450 | 580 | 76 | 750 |
| 60 | 1110 | 3320 | 580 | 78 | 680 |

TABLE V—VULCANIZATION OF 30 VOLUME HI-SIL 233 STOCK WITH THIAZOLE-GUANIDINE COMBINATION

Formula

| | |
|---|---|
| #1 Smoked Sheets | 100.0 |
| Zinc oxide | 5.0 |
| Hi-Sil 233 | 58.5 |
| Antiox. 2246 | 1.0 |
| Sulfur | 3.0 |
| MBTS | 0.8 |
| DOTG | 1.2 |
| Triethanol amine | 1.0 |
| Stearic acid | 3.0 |

| Mins. Cure 287° | Modulus 300% E. | Tensile | Elongation | Duro Hard | Tear lbs./in. |
|---|---|---|---|---|---|
| 7.5 | 670 | 3520 | 680 | 53 | 640 |
| 15 | 870 | 3820 | 660 | 58 | 750 |
| 30 | 1030 | 3830 | 640 | 62 | 770 |
| 45 | 1040 | 3790 | 610 | 62 | 720 |
| 60 | 1080 | 3760 | 600 | 65 | 680 |

## Silica in GRS-Type Rubber

As with natural rubber, the use of a reinforcing silica in styrene-butadiene synthetic rubber results in properties that are closer to carbon black than can be obtained with any other non-black pigment available at present. The reinforcement is of far greater relative importance in GR-S type than it is in natural rubber. Natural rubber is such a good material that a compound will have fairly good properties when even the cheapest fillers are used, which is not true in the case of GR-S type rubber. Better quality pigments are much more essential in the manufacture of rubber goods from the latter than from natural rubber. If good properties are required in anything other than a black stock, cheap clays or calcium carbonates cannot be used, and use of a reinforcing silica is essential.

Several points should be particularly kept in mind in compounding GR-S type rubber with reinforcing silica. The first of these, and this is true also of natural rubber, is that more acceleration is needed than with other pigments. Thiazole-thiuram combinations are more suitable than they are in natural rubber because there is much less tendency to revert with overcure. Combinations of 1 to 1.25 parts of MBTS with 0.25 parts of a thiuram are very good. Combinations of 0.75 to 1.0 parts of MBTS with 1.25 to 1.5 parts of DOTG also give excellent cures. It must be remembered that either of these combinations will also require about three parts of diethylene glycol or two parts of triethanol amine to give a cure in a reasonable time.

As is the case with other non-black pigments in GR-S type rubber, use of a coumarone-indene resin helps bring out the best tensile and tear properties. About 10 parts of resin in a 30 volume loaded stock, and proportionately smaller amounts for lower loadings, should be used.

Additional fatty acid is not required in regular GR-S type rubber compounds loaded with silica. However, when any of the low temperature copolymers are used, silica loadings make the stock sticky unless two or three parts of stearic acid are used as a lubricant.

In using either regular or low temperature GR-S type rubber it is not necessary to observe any special precautions in mixing silica stocks. Excessive mixing on an open mill does not lead to loss of physical properties, as it does in the case of natural rubber. Therefore, it is not necessary to get silica loaded GR-S type rubber batches off the mill quickly, nor is it necessary to mix pigment-elastomer masterbatches as was suggested for natural rubber.

The excellent physical properties which are imparted to GR-S type rubber and LTP by reinforcing silicas are shown in Tables VI and VII. They also impart exceptional properties to the nitrile rubbers, giving tensile strengths and tear resistances equal to that of black stocks, as shown in Table VIII.

TABLE VI—PHYSICAL PROPERTIES IMPARTED TO GR-S TYPE RUBBER BY REINFORCING SILICA

Formula

| | |
|---|---|
| GR-S 1000 | 100.0 |
| Zinc Oxide | 5.0 |
| Hi-Sil 233 | 58.5 |
| PBNA | 1.0 |
| Sulfur | 3.0 |
| MBTS | 1.2 |
| Me. Tuads | 0.15 |
| Diethylene Glycol | 3.5 |
| 100° C. mp Coumarone | 15.0 |

| Mins. Cure 280° | Modulus 300% E. | Tensile | Elongation | Duro Hard | Tear lbs./in. |
|---|---|---|---|---|---|
| 15 | 380 | 3030 | 830 | 64 | 340 |
| 20 | 445 | 3250 | 765 | 65 | 320 |
| 30 | 460 | 3230 | 720 | 66 | 285 |
| 45 | 495 | 3140 | 680 | 67 | 270 |
| 60 | 495 | 3120 | 675 | 69 | 265 |
| 90 | 525 | 3130 | 655 | 67 | 260 |

## Loading Materials for Neoprene Rubber

The reinforcing silicas are also excellent loading materials for neoprene rubber. No unusual techniques need be used either in mixing or curing silica loaded neoprene stocks. Silicas give much higher tensile and tear strength than can be obtained with any other non-black pigment without any decrease in elongation. When a high loading, such as 40 volumes, is used, silica gives the same hardness and much better tear resistance than EPC black although its tensile strength is slightly lower. At this

TABLE VII—PHYSICAL PROPERTIES IMPARTED TO LTP BY REINFORCING SILICA

Formula

| | |
|---|---|
| GR-S 1502 | 100.0 |
| Zinc Oxide | 5.0 |
| Hi-Sil 233 | 58.5 |
| Antiox. 2246 | 2.0 |
| Sulfur | 3.0 |
| MBTS | 1.25 |
| DOTG | 1.75 |
| Triethanol Amine | 1.0 |
| 100° C. mp Coumarone | 10.0 |
| Stearic Acid | 3.0 |

| Mins. Cure 287° | Modulus 300% E. | Tensile | Elongation | Duro Hard | Tear lbs./in. |
|---|---|---|---|---|---|
| 15 | 810 | 3440 | 620 | 63 | 260 |
| 30 | 1040 | 3850 | 590 | 68 | 310 |
| 45 | 1150 | 4140 | 590 | 68 | 320 |
| 60 | 1160 | 3900 | 560 | 70 | 290 |
| 90 | 1140 | 3710 | 560 | 71 | 300 |

TABLE VIII—PHYSICAL PROPERTIES IMPARTED TO NITRILE RUBBER BY REINFORCING SILICA

Formula

| | |
|---|---|
| Hycar 1041 | 100.0 |
| Zinc Oxide | 5.0 |
| Hi-Sil 233 | 58.5 |
| Agerite White | 2.0 |
| Sulfur | 1.5 |
| MBTS | 0.75 |
| DPG | 1.5 |
| Dioctyl Phthalate | 10.0 |
| KP-140 | 10.0 |
| Stearic Acid | 1.5 |

| Mins. Cure 310° | Modulus 300% E. | Tensile | Elongation | Duro Hard | Tear lbs./in. |
|---|---|---|---|---|---|
| 10 | 310 | 3200 | 820 | 65 | 350 |
| 20 | 400 | 3270 | 740 | 69 | 360 |
| 30 | 460 | 3560 | 720 | 69 | 350 |
| 45 | 510 | 3420 | 660 | 70 | 330 |
| 60 | 540 | 3520 | 650 | 70 | 330 |

loading, the elongation of the black stock is barely half that of the silica compound. Use of about 0.75 to 1.0 part of Permalux in Hi-Sil 233 loaded neoprene to speed up the rate of cure is usually desirable. Properties of this type compound are represented below in Table IX.

Reinforcing silica also is the answer to the problem of producing satisfactory non-black butyl rubber compounds. Clays, whitings and diatomaceous earths have been used to some extent, but do not give really satisfactory tensile strengths nor tear resistance. Silene EF is difficult to disperse. By use of Hi-Sil 233, easily processable stocks can be made with excellent physical properties. It mixes into butyl rubber and disperses without difficulty. Stocks are sticky, but this can be prevented entirely by use of an ester such as KP-140.

Excellent cures of silica loaded butyl rubber can be obtained by use of 2 parts of methyl Tuads, or by a combination of one part Tellurac with one part of Zenite. The former is recommended for white or pastel compounds, since the latter produces a yellow discoloration which is not noticeable in reds, yellow or greens but is readily discernible in whites, greys, blues or pastels.

Black butyl rubber compounds have generally been vulcanized with two parts of elemental sulfur. Theoretically, only a fraction of this amount is needed because of the high degree of saturation of butyl rubber, but in practice good vulcanizates are not obtained with elemental sulfur unless at least 1.5 parts or, more generally, 2 parts are used. Since this amount of sulfur is in excess of that which reacts with the double bonds in the polymer, the excess migrates to the surface of the vulcanized article where it appears as an unsightly grey bloom. This bloom is objectionable on the surface of otherwise brightly colored butyl rubber goods. Well cured stocks which do not bloom can be obtained by using a combination of elemental sulfur with an organic sulfide. The amount of elemental sulfur is less than that which will bloom but is not sufficient for a good cure. Additional sulfur in non-blooming form is provided by use of a material such as Sulfasan R. A combination of one part sulfur with 1.5 parts Sulfasan R gives excellent results in Hi-Sil loaded butyl rubber compounds, as shown in Table X.

TABLE IX—PHYSICAL PROPERTIES IMPARTED TO NEOPRENE RUBBER BY REINFORCING SILICA

Formula

| | |
|---|---|
| Neoprene GN | 100 |
| Hi-Sil 233 | 39 |
| ELC MgO | 4 |
| Zinc Oxide | 5 |
| Permalux | 1 |
| PBNA | 1 |
| Circo Oil | 10 |

| Mins. Cure 287° | Modulus 300% E. | Tensile | Elongation | Duro Hard | Tear lbs./in. |
|---|---|---|---|---|---|
| 10 | 390 | 1950 | 1000 | 51 | 310 |
| 15 | 700 | 3170 | 980 | 57 | 500 |
| 30 | 1010 | 3620 | 850 | 60 | 520 |
| 45 | 1140 | 3630 | 780 | 62 | 460 |
| 60 | 1230 | 3590 | 740 | 63 | 430 |

TABLE X—PHYSICAL PROPERTIES IMPARTED TO BUTYL RUBBER BY REINFORCING SILICA

Formula

| | |
|---|---|
| Butyl 265 | 100.0 |
| Zinc Oxide | 5.0 |
| Hi-Sil 233 | 39.0 |
| Sulfur | 1.0 |
| Sulfasan R | 1.5 |
| Me. Tuads | 2.0 |
| Diethylene Glycol | 2.0 |
| Paraffin | 0.75 |
| KP-140 | 1.0 |

| Mins. Cure 307° | Modulus 500% E. | Tensile | Elongation | Duro Hard | Tear lbs./in. |
|---|---|---|---|---|---|
| 7.5 | 280 | 2160 | 1020 | 55 | 300 |
| 10.0 | 370 | 2410 | 960 | 57 | 350 |
| 15.0 | 480 | 2540 | 910 | 56 | 280 |
| 20.0 | 520 | 2540 | 880 | 58 | 300 |
| 30.0 | 600 | 2600 | 840 | 62 | 290 |
| 60.0 | 690 | 2590 | 800 | 63 | 300 |

TABLE XI—COMPARISON OF CARBON BLACK-SILICA MIXTURES WITH CARBON BLACK IN NATURAL RUBBER

Formulae

| | A | B |
|---|---|---|
| #1 Smoked Sheets | 100.0 | 100.0 |
| Zinc Oxide | 5.0 | 5.0 |
| HAF Black | 50.0 | 30.0 |
| Hi-Sil 233 | —— | 21.6 |
| Flexamine | 1.0 | 1.0 |
| PBNA | 1.0 | 1.0 |
| Sulfur | 2.5 | 2.5 |
| Santocure | 0.5 | 0.62 |
| DOTG | —— | 0.48 |
| Triethanol Amine | —— | 0.2 |
| Stearic Acid | 3.0 | 3.0 |

| Compound | Mins. Cure 287° | Modulus 300% E. | Tensile | Elongation | Duro Hard | Tear lbs./in. |
|---|---|---|---|---|---|---|
| A | 15 | 2300 | 4100 | 490 | 63 | 700 |
| | 30 | 2770 | 4140 | 430 | 66 | 750 |
| | 45 | 2780 | 4090 | 420 | 66 | 640 |
| | 60 | 2700 | 3890 | 410 | 67 | 530 |
| B | 15 | 2110 | 4370 | 530 | 62 | 810 |
| | 30 | 2250 | 4200 | 490 | 64 | 770 |
| | 45 | 2200 | 4180 | 500 | 64 | 640 |
| | 60 | 2050 | 4070 | 500 | 64 | 630 |

## Mixture of Carbon Black and Silica

The answers to most problems are neither all black nor all white, but a certain amount of each. Possibly the answer to reinforcing rubber is the same, that is, that the best properties are not obtained from all black nor all white, but from a mixture of the two.

What happens when the compounder uses a mixture of reinforcing black and reinforcing silica? Table XI gives part of the answer. Modulus is down somewhat and hardness is off a point or two. Elongation is definitely increased. Tensile strength and machine tear resistance are, if anything, slightly increased.

As for abrasion resistance, it might be expected that compounds containing mixtures would lose resistance to road wear in direct proportion to the amount of silica present. This does not seem to be the case. Road abrasion resistance does not appear to be a straight line function of the amount of each reinforcing pigment present. Instead, the abrasion resistance of some mixtures lies much closer to that of all black compounds than would be expected.

In addition, something else happens. Compounds containing mixtures of the two pigments will have a much knottier hand tear than the all-black stock. The value of knotty hand tear is hard to define, but it would certainly seem to be desirable if obtained at no sacrifice of any other property. A rubber article which is cut or torn in service is useless if the resulting tear progresses entirely through it; if the tear is stopped at a short distance by a knot, the article continues to be serviceable.

Possibly the resistance to hand tear is related to the ability of a compound to resist cutting and chipping. About two years ago, we tried to demonstrate this by having two 21.00 x 25 rock service tires built with two part treads. One section of tread contained an all black loading and the other section a mixture of 30 parts black and 25 of silica. After 13 months service in our limestone mine at Barberton, there was no noticeable difference between the two sections. In this case, the mixed loading neither improved nor degraded the compound. Possibly some differences would have been noted in less severe service. It is my opinion that mixtures of reinforcing blacks and reinforcing silicas are worth considerably more study.

## Coming Next Month...

**The Physics of the Friction of Rubber on Rough Surfaces—By F. W. Boggs and W. P. Rieman, United States Rubber Co., Passaic, N.J.**

Dealing with the physics of abrasion, this paper discusses a proposed mechanism to test rubber loss and thereby to predict the merit of tread materials on the basis of laboratory data.

**Effect of Foaming Catalysts on Hydrolysis-Aging of Urethane Foams—By Dr. Joseph Winkler, American Cello Corp., Ridgefield, N.J.**

The author analyzes the role of the activator in the aging velocity of resilient foams, and describes research for a new activator which can be tied into the foam structure.

**Procedure in Obtaining Patents—By Kenneth W. Brown, Arthur S. Collins and Curt B. Beck, Godfrey L. Cabot, Inc., Boston, Mass.**

Part 3 of this four-part series considers the appeal of the rejected patent application, the divisional application, uses of the patent and the infringement suit.

**How Hewitt-Robins Tests Fire Hose—By John V. Kelly, Hewitt-Robins, Inc., Buffalo, N.Y.**

The testing of fire hose to see that it meets all specifications is an exacting procedure; one company has simplified the process by an ingenious dead-end hydraulic control.

*A tool for the study of rubber synthesis by plants*

# Rubber from Mushrooms

THE subject of an address presented at a recent meeting of the American Association for the Advancement of Science was "Synthesis of Rubber by Microorganisms." The authors, W. D. Stewart, Mildred R. Stewart and Charles Bielawski of the Atlantic Research Corp., stated that when in 1951 it was discovered that rubber could be extracted from certain types of mushrooms, as was reported by Stewart, Wachtel, Shipman and Yanko in *Science* magazine in 1955, it was apparent that these fungi, if they could be isolated and if they produced rubber in pure culture on liquid artificial media, would serve as useful tools for studies on the mechanism of rubber synthesis by plants.

Their enzymatic systems are less complex than those of the higher plants, since they lack chlorophyll and the catalytic systems associated with the photosynthetic activities of green plants. Since rubber and other isoprenoids such as the steroids may quite possibly be derived from the same starting materials or "chemical building blocks", these fungi may prove to be equally valuable to the hormone chemist in elucidating the mode of synthesis of steroids by the cell, and in the biosynthesis of new hormones.

The Atlantic Research Corp. carried out a program of research, sponsored by the Office of Naval Research, to determine the feasibility of isolating and culturing species of fungi known to be capable of rubber synthesis, of adapting them to cultivation on liquid media in order to determine the ability of these isolates to produce rubber on artificial media, and to devise appropriate methods for the separation and characterization of the rubber produced by selected strains.

More than 20 species of the rubber-producing, latex-bearing genus, Lactaria, were collected with the aid of mycologists at universities from several states. Many of these were isolated in pure culture. Some of the species proved to be fastidious in their nutrient requirements, and either grew slowly or not at all on standard media for the cultivation of fungi. All required a source of organic nitrogen for good growth.

Five of the fastest growing species, and several mutants obtained from these fungi by irradiation with electrons, were grown in liquid media using a two-week culture period at temperatures ranging from 22 to 26°C. until sufficient cell material was harvested for rubber extractions. The harvested materials, after freezing and thawing to rupture the cells, were extracted with alcohol, acetone and benzene, while they were blanketed with nitrogen.

The benzene extracts of all five species yielded compounds, which could be precipiated from solution with methyl alcohol, ranging from "sticky", viscous liquids to elastic rubbery solids. Infra-red spectra show that these polymers are much more highly oxygenated than those extracted from the spore-bearing structures. It is not known whether this is an innate property of the polymers produced by the mycelia which may serve as precursors for the synthesis of cis-polyisoprene, or whether it is due to oxidative degradation under the cultural conditions employed.

The cells of the fungi are rich in acetone extractables. The acetone soluble material from the cells of one species was saponified, and the unsaponifiable fraction soluble in methanol separated. After several recrystallizations from methanol a substance was obtained which gave the color reactions typical of steroids. Its infra-red spectrum had the absorption bands expected of an isoprenoid.

## Higher Steam Pressures in Rubber Factories

AN interesting paper on higher steam pressures was read some time ago at a meeting of the American Society of Mechanical Engineers. In discussing the paper a prominent consulting mechanical engineer stated that in one plant a 5,000 kilowatt turbine-generator took steam at 250 pounds per square inch pressure and exhausted it at 80 pounds per square inch, the exhaust being used in a process system. In that way the unit delivered power for less than one-half cent per kilowatt hour, taking into consideration all charges—overhead, maintenance, depreciation, interest, etc. Another prominent engineer stated that in industrial plants the "highest practicable steam pressure and temperatures should always be considered." The implications of his statement may well be weighed by the rubber industry.

Because of the fact that comparatively few rubber factories are operating at high pressure and temperature at the present time, there are no "standards" as yet, but they will naturally follow in time. Enough is already known about high pressure and high temperature operation so that engineers can closely predict the economies that will result. These things are no longer an entirely unknown quantity and in many respects are well through the experimental stage. Of one thing we can be sure, to wit: rubber plants will always continue to be improved, year after year, without end. W.F.S

# Editorials..

## Goodrich Suit

► THE government suit against the B. F. Goodrich Company over the *cis*-polyisoprene rubber which bears the market name of Ameripol SN could easily come under the category of: Well, here we go! Because of the many facets involved in the birth, growth and development of synthetic rubber in the United States, it was almost inevitable that somewhere along the line there would be litigation between the government and one or more of the active participants in the over-all program. It is just happenstance that the polymer involved is *cis*-polyisoprene and that the defendant is Goodrich. It might have been any other type polymer and any other rubber manufacturer.

In the case at issue, the Federal Government has filed suit at Washington, D.C. to force the B. F. Goodrich Company to disclose details of its process for producing Ameripol SN so that it can make these details available to the entire industry, presumably for the public good. According to the charges, Ameripol SN was developed by the Goodrich organization with government money. Specifically, the government claim is based on research contracts issued to Goodrich between the period 1949 and 1955. Actually, the announcement on Ameripol SN was made on December 2, 1954, by Goodrich Gulf-Chemicals, Inc.

In commenting on the suit, Goodrich officials declared that the discovery of Ameripol SN was a development of Goodrich-Gulf Chemicals, Inc., and bore no relationship whatsoever to the research contract between the B. F. Goodrich Co. and the government. (Goodrich-Gulf is jointly owned by Goodrich and the Gulf Oil Corp.). Further, they stated that the development was based upon scientific knowledge purchased by Goodrich-Gulf in Europe in 1954. They emphasized the point that since the discovery was made with private funds of Goodrich-Gulf Chemicals and Ameripol SN is the property of that company, there is no justification for the government's claims.

The actual basis for the suit lies in the wording of the research contracts issued to Goodrich in 1949 and subsequent years. Like all other government contracts of this type, they included a section in which the recipient of funds agrees to make full disclosure of all discoveries, regardless of whether such discoveries stem directly from government-financed research. The contracts also provide that any discoveries resulting will be turned over to the government on a royalty-free license basis with permission to disclose the data to others.

The research contracts referred to have a deeper history and, in a sense, stem from the patent pool which was in operation during the wartime period. The pooling agreement, which provided for exchange of information and the pooling of patents in the development of synthetic rubber, was signed in December, 1941, by six companies—Goodrich, Goodyear, U. S. Rubber, Firestone, Standard Oil and Phillips Petroleum. Under the terms of the pool, all technical developments were made known to the government which distributed the details to all participants. This pool arrangement was terminated in December, 1949. Some of the terminology was continued in the research contracts which were subsequently issued.

Who can tell at what point in a research investigation a spark is ignited which will eventually burst into flame? How do you creep into the research investigator's mind to determine how and when the brain cells click into position to shed new light on an old problem? Among some of our newer polymers, which were conceived during the operation of the patent pool? The research contracts? Privately conducted research? How do you determine the legal line if you are walking a path between private and government-financed research?

Some of these questions are not involved in the current litigation. The government claim is based on specific research contracts. Goodrich states that the discovery was made with private funds of Goodrich-Gulf Chemicals, which did not have any contract with the government and, further, that it was based on scientific knowledge purchased in 1954 in Europe. The legal arguments seem to be on firm ground. But, we repeat, because of the thin line between patent pool, government-financed research contracts and private research, litigation between government and industry on synthetic rubber was inevitable. So, here we go!

## Well Done!

► AS reported elsewhere in this issue, the Joint Conference of the Divisions of Rubber Chemistry of the American Chemical Society and the Chemical Institute of Canada which was held in Montreal last month was a successful affair. The more than 1,300 registrants attending the meeting were accommodated with a minimum of fuss and inconvenience. The Civic Reception tendered by the City of Montreal struck a particularly hospitable note. The meeting rooms were good and the luncheons, banquet and hospitality rooms were well-arranged. Although Bob Huggenberger and John MacDonald deserve most of the credit as co-chairmen of the Local Arrangements Committee, many other persons obviously took great pains in handling the numerous details involved in such an affair. It is a pleasure to say: Well done!

# Highlights Sidelights *of the News...*

June, 1957

Firestone has offered $760,000 for the Government's synthetic rubber research laboratories and pilot plant at Akron, Ohio, thus more than tripling other bids made by Thiokol Chemical and the Smithers Laboratories . . . General Services Administration advises that it will turn all three bids over to the Bureau of the Budget so that they can be compared with "offers of interest" from a number of Government agencies . . . The Budget Bureau must decide whether the Government's best interests lie in keeping the facilities or in selling them to some private concern (page 487).

Goodrich has lost another round in its fight to uphold its tubeless tire patents . . . A Circuit Court of Appeals has affirmed a lower court decision that the company's claims re its tubeless tire patents are invalid . . . The company has a similar suit pending in Cleveland (page 488).

The practice of a group of steamship companies of pooling rubber shipments from Thailand to the U.S. has been defended by a member of the Federal Maritime Board . . . The FMB member stated that the participation of two subsidized lines in the pooling arrangement has not been shown to contravene the purposes, policy or provisions of the Merchant Marine Act . . . He noted that no line has complained that it is not getting its fair share of rubber (page 493).

The Department of Justice has filed an action against Goodrich demanding that the company disclose full information on its formula for natural-like synthetic rubber . . . The suit alleges that the process was developed by Goodrich with Government funds . . . Goodrich states that the research was performed privately with private funds of Goodrich-Gulf Chemicals, Inc., and declares that there is no justification for the Government claim (page 491).

Goodyear has completed a $10 million expansion program at its Houston, Texas, synthetic rubber plant which will boost capacity of the installation to 220,000 long tons a year . . . It is said that the plant thus becomes the world's largest single producer of dry synthetic (page 493).

SPECIAL REPORT

Synthetic rubber in Europe. Marked increases in production scheduled with the construction of several new plants (page 486).

# NEWS REPORTS and Industry Activities

## A. C. S. and C. I. C. Rubber Divisions Hold Joint Meeting in Montreal

*Twenty-three technical papers feature May 15 to 17 sessions*

Present and past executives of the Rubber Divisions A.C.S. and C.I.C. seated on the dais at the banquet held on May 16 at the Sheraton-Mount Royal Hotel in Montreal.

► The first Joint Conference of the Divisions of Rubber Chemistry of the American Chemical Society and the Chemical Institute of Canada was held at the Sheraton-Mount Royal Hotel in Montreal, Canada, from May 15 to 17. The successful nature of the joint meeting is best exemplified by the fact that official registration amounted to 1316. This was made up as follows: A.C.S. members, 791; C.I.C. members, 110; non-members, 216; ladies, 199.

The meeting featured the presentation of twenty-three technical papers at four sessions, an address by W. B. Wiegand on "Carbon Black" in recognition of the Colwyn Metal Award, business meetings of both the American and Canadian divisions, a meeting of the 25-Year Club of the ACS Rubber Division, a special reception by the City of Montreal, a program for the ladies, and a banquet.

The technical papers were divided into four major categories, namely: Testing Procedures, Carbon Black, Compounding and Processing, and New Polymers. Among subjects covered were a new technique for producing longer wearing tires, the effect of exposing rubber products to atomic radiation, the use of lignin in rubber compounds, a method of observing the effects of temperature on the flow of mechanical rubber goods, a new instrument that produces continuous dynamic flexing, and a rapid method of processing rubber in liquid form. (Abstracts of all papers presented at the Montreal meeting appeared in our April issue.)

Following the procedure established in recent years, various people presided over each of the four technical sessions. Dr. B. S. Garvey, Jr. (Sharples Chemicals), chairman of the ACS Rubber Division, presided at the first session; O. R. Huggenberger (Dominion Rubber), retiring chairman of the CIC Rubber Division, and chairman of the Local Arrangements Committee, at the second; J. D. D'Ianni (Goodyear), delegate-at-large of the ACS Rubber Division, at the third; and N. S. Grace (Dunlop-Canada), who acted as liaison officer between the two groups and who presided over the meeting of the 25-Year Club, at the fourth and final session.

### *Civic Reception Held*

The Civic reception, to which all registered delegates were invited, was held on Wednesday evening, May 15, at the Mountain Chalet at the top of Mount Royal. It was well-attended and earned plaudits from all concerned. A short speech of welcome was made by Acting Mayor Murray Hayes. Earlier the same day, officials of both the ACS and CIC Rubber Divisions were formally received at City Hall by Mayor Drapeau. (NOTE: The Acting Mayor at Montreal is actually a Deputy Mayor, serving as an assistant to the Mayor.)

The Ladies' Program included a get-together buffet luncheon, tours of the City of Montreal, and an all-day tour to the Laurentian Mountains with luncheon at the well-known Mont Gabriel Club.

In his talk on "Carbon Black," which

was given during the technical session on Thursday morning. Mr. Wiegand, director and research consultant of the Columbian Carbon Co., devoted the major portion of his allotted time to what he called "the tentative dew line for hot mixed cold rubber ISAF treads." An abstract of the talk follows:

Sweitzer and collaborators have shown (*Rubber Age*, p. 651, Sept., 1949) that carbon gel is a central factor in carbon reinforcement. A study of a "cold" (4 mins. @ 250°F.) versus a "hot" (10 mins. @ 388°F.) laboratory Banbury mixed cold rubber tread with 550 phr ISAF black shows the usual change in physical properties from the cold to the hot mix, viz.: carbon gel up from 25% to 45%; rebound up from 55% to 57%; log resistivity up from 4 to 6; 300% modulus up from 1950 to 2760 psi; tensile strength down from 3450 to 3380 psi; elongation down from 485% to 425%.

Microtome sections cut from cured samples of these mixes which had been swollen and embedded in methacrylate monomers and later polymerized were photographed by W. Hess in the Columbian electron microscope at 25,000 diameters. The following features were observed: (1) Overall in going from cold to hot: increased contrast and differentiation; (2) Carbon phase in both mixes: relative absence of particulate carbon, ultimate units seeming to be carbon chain segments in various configurations; (3) Carbon gel complexes: in general, absent or small in the cold mix, prominent in the hot. These aggregates or clumps comprise closely packed carbon particles embedded in gel matrix. In the hot mix the carbon gel complexes tend to be large (equal to 40 particle diameters); (4) Clear areas: visible in both mixes but more sharply defined in the hot; shape generally equidimensional (*Ind. Eng. Chem.*, p. 2564, Nov., 1951).

From the above facts it is deduced that:

(1) Presence of numerous discrete clear areas implies that distribution of carbon must conform to that postulated in the discrete rubber theory (for Hevea) (*Can. Chem. & Met.*, p. 35, Feb., 1937) rather than to that inherent in any uniform, particulate carbon theory. Some polymer entity either survives, or is generated, which is surrounded by carbon particles but is itself free of carbon. The early maxima in the loading curve may now be rationalized without postulating any particular mechanism such as the survival of latex globules (*Can. Chem. & Met.*, p. 35, Feb., 1937).

(2) Concentration of carbon in large gel complexes implies lower carbon content in the matrix as a whole; hence, higher log R and rebound but, due to carbon starvation, lower tear and tensile strength.

(3) Presence of large carbon gel complexes implies, on deformation, fibering; hence, higher modulus, lower elongation and tear.

In conclusion, insofar as hot mixing promotes complete wetting of the carbon phase, the effect should be to raise reinforcement without reducing elongation or tear.

When hot mixing has been carried to the point of maldistribution of the carbon phase, with some areas over and others under populated, however, reinforcement becomes distorted, through fibering of the carbon gel complexes, in favor of modulus and rebound at too high a cost in tear, elongation and, eventually, in tensile strength.

A tentative three-point warning against over heat treatment of LTP SBR-ISAF black tire tread might include that: (1) Tensile strength should not decline as against a control mixed under 300°F.; (2) At a tight cure, elongation should not fall below some rigid specification, i.e., 500% but depending on carbon loading; (3) Electron microscope transparencies should not show large (40 particle diameter) carbon gel complexes as predominant in the field.

### *Active Business Session*

Because of the joint nature of the conference, separate business meetings were held concurrently by the two participating organizations. These were held on Thursday morning, at the Sheraton-Mount Royal. The ACS Rubber Division business session was held in the ballroom and that of the CIC Rubber Division elsewhere in the hotel.

The first order of business at the ACS Rubber Division session, presided over by Chairman Garvey, was a moment of silence observed for members who had died since the previous meeting. These included: A. M. Neal (DuPont), H. Connell (Armstrong Tire), L. F. Rogers (Continental Can), R. A. Mathes (Goodrich Research), and E. B. Caldwell (Mare Island Rubber Laboratory).

Seward Byam

*acting ACS Rubber Division secretary.*

Chairman Garvey then advised of several actions taken by the Executive Committee, including the appointment of S. D. Gehman (Goodyear) as an associate editor of *Rubber Chemistry and Technology*, that of S. G. Byam (DuPont) as acting secretary of the division, and that of R. H. Gerke (U. S. Rubber) as secretary for the balance of the year. Mr. Byam took over almost immediately on the death of Mr. Neal and is currently in process of turning the records over to Mr. Gerke.

It was further announced that the Executive Committee had established a committee, consisting of Mr. Byam and J. M. Ball (Midwest Rubber Reclaiming), to prepare a special manual for the guidance of officers of the division; that it was considering appointing assistants to work with the key officers, and that it may recommend a change in the by-laws which would permit the election of a secretary-treasurer for a three-year term rather than the one-year term presently provided.

H. W. Hoerauf (U. S. Rubber), chairman of the Membership Committee, then reported that as of May 1, 1957, the Rubber Division had 2544 regular and 504

Shown above in the usual order are the Messrs. Huggenberger and Garvey, Copeman and Grace and Wiegand and Whitby.

associate members, for a total of 3048. This was a loss of 46 since the previous report last September, and Mr. Hoerauf coupled his report with a plea for more active solicitation for new members on the part of present members.

Nominations of officers to serve for the 1957-58 period were announced by D. F. Behney (Harwick Standard Chemical) in his capacity as chairman of the Nominating Committee. These were: *Chairman*, R. F. Dunbrook (Firestone); *Vice-Chairman*, E. H. Krismann (DuPont) and Sheldon C. Nicol (Goodyear); *Secretary*, R. H. Gerke (U. S. Rubber); *Treasurer*, George E. Popp (Phillips Chemical). The following nominees were selected from the various rubber groups to serve two-year terms as directors:

*Connecticut*, Warren Carter (Pequanoc Rubber) and Harry Gordon (Bond Rubber); *Detroit*, J. F. Stiff (Columbian Carbon) and R. W. Malcolmson (DuPont); *Northern California*, C. A. Stephens (National Seal) and R. J. Reynolds (Shell Development); *Philadelphia*, R. J. Salyerds (Harwick Standard Chemical) and M. A. Youker (DuPont); *Rhode Island*, R. W. Szulik (Acushnet Process) and R. B. Robitaille (Phillips Chemical); *Southern Ohio*, F. W. Gage (Dayton Chemical Products) and K. C. Tregillus (Vernay Laboratories); *Washington, D.C.*, A. W. Sloan (Atlantic Research) and G. W. Flanagan (Goodrich Chemical).

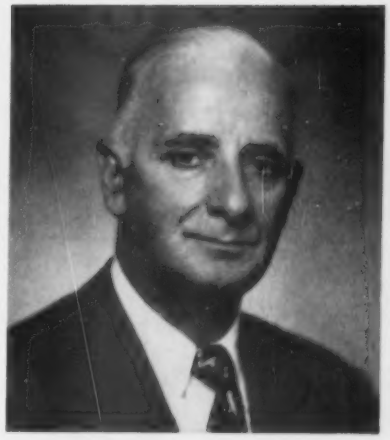
It was also announced that Arthur W. Carpenter had been selected to receive the Charles Goodyear Medal for 1957. Mr. Carpenter, former secretary of Committee D-11 on Rubber and Rubberlike Materials, American Society for Testing Materials, recently retired from the B. F. Goodrich Co. While with Goodrich, he served as manager of physical testing in the Manufacturing Services Division of the company. (A comprehensive biography of Mr. Carpenter will appear in our next issue.)

### *C.I.C. Business Meeting*

At the business meeting held by the C.I.C. Rubber Division, the following officers were elected for the new season: *Chairman*, H. K. Cunliffe (Dunlop-Canada); *Vice-Chairman*, J. A. Garr (Dunlop-Canada); *Secretary-Treasurer*, W. H. Bechtel (Canadian General-Tower). The following members were elected to the Executive Committee: Hector Lazzerotto (Polymer), John MacDonald (DuPont-Canada), Alex Jaychuk (Goodyear), and Carl Croakman (Columbian Carbon). It was decided at the business session that the division will hold its Annual Meeting in 1958 in association with the parent society.

### *Banquet Is Well Attended*

A capacity crowd of approximately 1,000 attended the banquet, which was held in the ballroom of the hotel on Thursday evening. After toasts had been made to the Queen and the President, an excellent dinner was served. Following dinner, Dr. Garvey expressed the thanks of the ACS Rubber Division for the Montreal arrangements and then introduced those seated at the dais. He also delivered a short eulogy in memory of Dr. Neal.



R. H. Gerke
*named ACS Rubber Division secretary.*

Short talks were made by several of the guests seated on the dais including: Herve L'Heureux, American Counsul General stationed in Montreal; Clark E. Richardson, Q.C., M.P., representing the City of Montreal; C. B. Copeman, representing the Institution of the Rubber Industry; Dr. Clifford Purvis, president of the Chemical Institute of Canada; and Roy Avery, representing the American Chemical Society. All of these talks lauded the idea of joint American-Canadian conferences.

The highlite of the banquet was the presentation of the Colwyn Medal to Mr. Wiegand. This is the highest award made by the Institution of the Rubber Industry and the Montreal meeting marked the first time presentation of the medal was made outside of England. It was appropriate that the presentation to Mr. Wiegand was made at a joint American-Canadian meeting, since Mr. Wiegand was born and educated in Canada and has been a resident of the U.S. for many years.

The actual presentation was made by Dr. G. Stafford Whitby in behalf of the I.R.I. Dr. Whitby, once Professor of Organic Chemistry at McGill University in Montreal and now Professor Emeritus of Rubber Chemistry at the University of Akron, was the first recipient of the Colwyn Medal. Prior to the actual presentation to Mr. Wiegand, Dr. Whitby delivered a talk on "Wiegand, the Man."

In his talk, Dr. Whitby traced the medalist's life from his birth in Conestogo, Ontario, in 1889, his graduation from the University of Toronto in 1912 with a major in chemistry, and his work with the Dominion Rubber Co., Ames-Holden-McCready Co., Ames-Holden Tire Co., and since 1925 with the Binney & Smith and Columbian Carbon companies. He emphasized the importance of Mr. Wiegand's contributions to the practices of rubber compounding and to the theoretical understanding of the effect of blacks in rubber.

Referring to some of the work accomplished by Mr. Wiegand in the field of carbon black, Dr. Whitby mentioned the paper published in 1920 on the effect of black in raising the energy-storage capacity of rubber which provided for the first time a rational basis for the study of rubber reinforcement. It was at this time that Mr. Wiegand dubbed carbon black "the king of pigments." Reference was also made to some of the work done by Mr. Wiegand on such aspects of the basic physics of rubber as hysteresis and the Joule effect. His continued interest in Canada was emphasized by the fact that he gave valuable service during World War II as a member of the Canadian Technical Advisory Committee on Synthetic Rubber.

The speaker also made mention of several other accomplishments of the medalist, including his skill as a writer, his active interest in the field of education, and his knowledge of Latin and Greek. Dr. Whitby revealed that since the medalist's retirement in 1951 from the position of vice-president of the Columbian Carbon Co. he has taken at Columbia University the degree of Master of Arts in Greek.

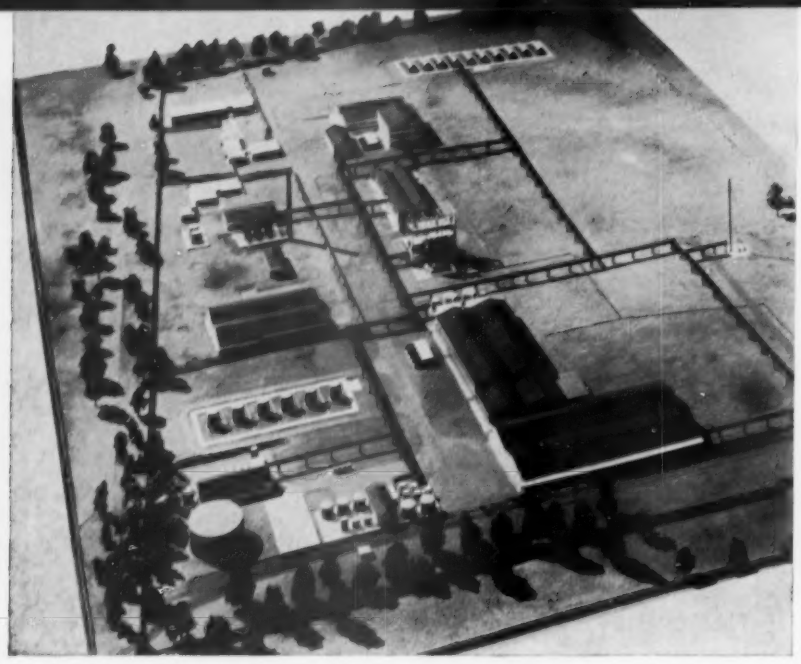
In accepting the Colwyn Medal from Dr. Whitby, Mr. Wiegand expressed his deep appreciation for the honor and extended his personal thanks to several members of the Columbian Carbon technical staff who worked with him on many of his research programs. The banquet was concluded with the presentation of a well-rounded variety show.

### *Meeting of 25-Year Club*

The meeting of the 25-Year Club, which was held in the Champlain Room of the Sheraton-Mount Royal on Wednesday noon, was well attended. It was the 18th meeting of the group to be held. After an excellent lunch, Norman Grace (Dunlop-Canada), who presided as chairman, delivered greetings to the group from the Mayor of Montreal. A moment of silence was then observed for four members of the club who have passed away since the last meeting. These were: A. M. Neal (DuPont), R. A. Mathes (Goodrich Research), U. H. Parker (Dryden Rubber), and E. A. Foote (R.M.A.).

Dr. Grace then introduced several guests present at the meeting, including C. B. Copeman, chairman of the board, Maclaren & Sons, Ltd., London, England; Horace Dean, of Chance & Hunt, London, England, and H. B. Williams of Harrisons & Crosfield of Canada. Several new members present for the first time were introduced, including Ralph Wolf (Columbia-Southern Chemical). It was announced that the next meeting of the club would be held at the Commodore Hotel in New York next September, with W. O. Hamister (Naugatuck Chemical) as chairman.

Following traditional practice, a silver money clip was presented to the person present with the longest period of service in the rubber industry. Because of the joint nature of the Montreal meeting, Canadian and British guests were permitted to participate. The award went to Mr. Copeman on the basis of 51 years of continuous contacts in the field. Mr. Copeman's company publishes the *Rubber Journal* in London, as well as numerous other industrial and merchandising journals.



Architect's conception of the new synthetic rubber plant being constructed for the International Synthetic Rubber Corp. at Fawley, England.

# Synthetic Rubber in Europe:

## *Marked increases in production scheduled with the construction of several new plants*

► A sharp rise in European synthetic rubber production is expected to take place during the next two years with the construction of synthetic rubber plants in England, France, Germany and Italy, all of which are scheduled to be in production by 1959. The largest synthetic rubber plant in western Europe should be completed in Britain next year. Sponsored by four companies, one British (Dunlop), two American (Firestone and Goodyear) and one French (Michelin), the 50,000 ton Fawley plant is slightly larger than the West German plant under construction at Huels, but considerably smaller than a pre-war plant operating in East Germany, whose production is estimated to be 80,000 tons a year. Britain will also have two other plants in production this year, both of them producing special rubbers. Neither is expected to produce enough to meet the country's needs.

Present usage of synthetic rubber in Britain comprises 20 per cent of total rubber usage. In the future, synthetic rubber, chiefly in the form of tires, is expected to play a large part in Britain's rubber product exports. When the Fawley plant starts production, Britain will probably export rubber in large quantities, frequently in competition with the West German, French and Italian types.

### *Pricing Undecided*

There are no indications as to how the Fawley product will be priced. Until trial runs are finished, it will be impossible to estimate costs with enough precision to formulate prices. To meet American competition in the home market, traders expect the British product to sell at least below the American landed price of 2/1d per pound. If cost is lower than the West German types, there may be bigger prospects in the European free trade scheme than has been expected.

Some traders have already indicated that this year's large import quota of 87,000 tons of synthetic is unlikely to be taken up because of the unsettled state of the motor industry. They point to stocking up which took place last year and now acts as a brake on future imports. Apart from the quota, the new plant will not have any form of government assistance.

The first synthetic rubber plant in France is now being built near Le Havre. The plant will have a 20,000 ton capacity and is due to come into production in 1958. Its main product, butyl, will be made under license from Esso. This plant will permit France to meet her own butyl needs from domestic sources and will also leave a substantial margin for export.

French synthetic rubber consumption, now fed wholly by imports, has shown a sharply rising trend over the last two years. It accounted for 20 per cent of total rubber consumption in 1956, compared with 15 per cent the year before.

Principal suppliers recently have been the United States, Canada, West and East Germany. The return of American sellers to the world market was immediately followed by larger French purchases of synthetic, which was reflected in monthly domestic consumption figures. The trade predicts even larger imports in the coming months, mainly of GR-S types. A monthly average of 1,754 tons were imported by France in 1956. The future of French synthetic consumption will greatly depend on motor industry prospects although industrial rubber goods account for a growing share to total consumption.

In recent years, the import of synthetic has been less a question of finding the necessary foreign exchange than of finding sellers. Import business in France is concentrated on a small number of agents for the major international producers. Foreign exchange has been readily available as the main users are also large exporters such as the French tire industry.

As a raw material, rubber is exempt from the 15 per cent compensation tax imposed uniformly on all liberalized goods. Moreover, the obligation to make an advance deposit of 25 per cent on the import value is not expected to cause rubber importers much hardship, as much of the consumer industries have sufficient backing to carry this additional burden.

Although no synthetic rubber is manufactured in Italy at present, it is expected that by 1959 the country will produce a sufficient quantity for domestic requirements as well as substantial export. A new plant, under construction at Ravenna, will have an annual capacity of about 30,000 tons of GR-S type rubber produced from methane. Offially, production should start in March, 1958, but experts believe that present progress indicates that it cannot begin before 1959.

The builders, Azienda Nazionale Idrogenazione Carburanti company, estimated Italian consumption in 1958 at about 15,000 tons. Thus if demand were maintained at this level in 1959, some 15,000 tons would be available for export.

Latest official statistics show that Italy imported 14,985 tons of synthetic in the first 11 months of 1956, about the same amount as was imported in the corresponding period of 1955. The United States was the chief supplier with 8,734 tons. Canada supplied 5,910 tons.

### *Synthetic Ratio On Rise*

The European consumption ratio of synthetic to natural has been steadily increasing over the past few years and this trend is expected to continue. In 1957, it is put at 18-20 per cent against 15 per cent in 1954. This trend reflects increased usage rather than preference for the synthetic product. Over-all consumption is expected to rise about 24,000 tons above the 1954 level to 84,000 tons.

An associate company, Cledca, has been operating a pilot plant for the manufacture of synthetic rubber for three years, producing some four tons a day. It is believed that results have not been satisfactory and this has now been superseded by the cheaper Ravenna project. The builders calculate production costs at 309 lire per kilo, which compares favorably with the landed price of 367 lires, including duty, for the Canadian product.

## Firestone Tire High Bidder on Government Laboratories

► Firestone Tire & Rubber Co. has offered $760,000 for the Government's rubber research laboratories and pilot plant at Akron, Ohio. The offer to the General Services Administration was more than triple each of the other two bids—$251,278 from Thiokol Chemical Corp. of Trenton, N.J., and $245,000 from Robert G. Dunlap, doing business as Smithers Laboratories in Akron, Ohio. GSA said it will turn over all of the bids to the Budget Bureau for comparison with "offers of interest" from a number of Government agencies.

Under the disposal law enacted by Congress last summer, GSA was directed to survey the Government before offering the facility for private sale. The best Government offer, it is understood, came from the Department of Agriculture, interested in the laboratories for its food research program.

Budget Director Percival Brundage must decide whether the Government's best interests lie in (1) keeping the facility or (2) selling it for enough to build specialized facilities for the most interested Government agency.

The Akron facilities were built during World War II for research and development on synthetic rubber. Bordering on Firestone property, they were operated exclusively by Akron University until they went into standby about a year ago.

Ralph W. Deemer

J. Paul Mathews

## Deemer and Mathews Advanced by Republic Rubber

► Ralph W. Deemer has been appointed factory manager and J. Paul Mathews, manager of development and research, at the Republic Rubber Division of the Lee Rubber & Tire Corp., Youngstown, Ohio. Both positions are newly created. Mr. Deemer had been production manager while Mr. Mathews advances from the position of chief chemist. Both men have been with Republic for a number of years. Mr. Deemer started in production in 1926, transferred to sales in 1941, became assistant sales manager in 1946, and was made production manager in 1950. Mr. Mathews came to Republic as a chemist in 1926.

### K-1014 Silicone Compound

► A new compound which meets—and exceeds—rigid U. S. Navy specifications for silicone rubber coated glass tapes for cable insulation aboard ships and submarines is now available from the Union Carbide Corp., New York, N. Y. Called "K-1014 Silicone Rubber Compound", it is marketed as either a 100 per cent silicone solids compound or a 35 per cent solids coating solution in toluene. It is outstanding for its excellent electrical properties and coating characteristics, the company states. K-1014 is primarily designed for use as a basic stock for solvent coating solutions. It exceeds U. S. Navy Shipboard Cable Specification MIL-C-2194B for coated glass tapes with high dielectric strength, high crease resistance, and high moisture resistance.

### Glycosperse Foam Minimizer

► Glyco Products Co., Inc., New York, N. Y., has announced the development of "Glycosperse," a special surfactant that acts as a pigment grinding aid and foam minimizer in the production of coatings based on butadiene-styrene copolymers, polyvinyl acetate and acrylate latices. Through the use of Glycosperse, the finished coating levels well and eliminates brush marks and pitting. It is not only compatible with most additives, but aids in their solution and stability, the company states. Glycosperse is a straw-colored, oily, non-viscous liquid that is 100 per cent active and contains no diluents.

### Super Rib Industrial Tire

► A new multi-purpose pneumatic industrial tire, called the "Super Rib", has been introduced by the Goodyear Tire and Rubber Co., Akron, Ohio. Designed for use on boat trailers, fork lift trucks, industrial tractors, mine cars, baggage loaders, aircraft servicing vehicles and military material handling equipment, the tire is available in tubeless or tube-type ranging from 3.40/3.00 x 5, 2-ply, to 7.50 x 10, 12-ply rating. The tire features deep-cut slots in five saw-tooth riding ribs which, during compression with driving surfaces, minimize spinning and skidding. A balanced design places equal load on each cord, while the tire's wide, flat tread augments its stability and assures safer vehicle loading, the company says. The cord body of the Super Rib is subjected to Goodyear's 3-T triple-tempering process which is said to control cord stretch, virtually eliminate tire "growth" and cracking and make the casing resistant to heat and bruises.

### Maco Resin Emulsions

► A complete line of resin emulsion compounds and tackifiers has been developed by the Midland Adhesive and Chemical Corp., Ferndale, Mich. These products, known as "Maco Resin Emulsions", embrace most all properties of various synthetic and natural resins, and are prepared in water emulsion for incorporation in adhesives, rug back compounds, coatings, etc. Most Maco Resin Emulsions are compatible with all types of natural and synthetic latices.

### New Polyethylene System

► Chase Chemical Corp., Pittsburgh, Penna., has announced the development of an improved polyether-based "Nafil" resin and catalyst system to produce flexible Nafil polyurethane foams. It is claimed these have unique foaming and physical characteristics. Low density flexible Nafil polyether-based poylurethane foams, produced by mixing Nafil CF Resin and IM Catalyst, set and are tack free so that they can be handled 5 minutes after pouring, and cure in 10 minutes without the use of external heat or pressure. Nafil CF Resin and IM Catalyst are stable and have excellent shelf life, the company states. They are used without modification as shipped by Chase Chemical. The new flexible Nafil polyether-based polyurethane foams are very easy to use by simply mixing the Nafil CF Resin and IM Catalyst together in the correct proportions and pouring or spraying them in place where they will foam, set, and cure at room temperature. The metering, mixing, and dispensing can be accomplished by automatic machines; or by hand, using simple inexpensive equipment already in use in most plants. Flexible Nafil polyether-based polyurethane foams can be produced at present in 2 to 24 pounds per cubic foot density. Chase points out that flexible Nafil polyether-based polyurethane foam produced by using its new Nafil CF Resin and IM Catalyst has physical characteristics approaching that of foam rubber—in addition to being lighter weight, fire and solvent resistant, and more economical to produce. The foam is ideally suited for such uses as light weight fire resistant cushioning, etc.

## Goodrich Loses Appeal on Tubeless Tire Patents

► B. F. Goodrich Co. has lost another round in its fight to uphold its tubeless tire patents. The Fourth U.S. Circuit Court of Appeals at Richmond, Va., has affirmed a lower court decision that the company's claims are invalid. Last December 12, Federal Judge R. Dorsey Watkins of Baltimore turned down the company's contention that the U.S. Rubber Co. had infringed on the patent. Judge Watkins concluded Goodrich's claims "are invalid, but if valid, are not infringed by the defendant." Three circuit judges wrote that the Baltimore court gave a comprehensive review of the case and that the "facts were carefully and correctly set forth."

Goodrich, which introduced the first tubeless tires on the market and made them commercially successful, obtained a series of patents, starting February 26, 1952. Goodrich contended U.S. Rubber was building tires with two features covered by its patent.

Appeals judges cited old patents on tubeless tires in holding the Goodrich claim invalid. They said liners and sealing ribs which are admittedly old, have separate functions. To put them together in one tire is a mere aggregation, they added, and not an invention.

The Richmond court contended it is not an invention to substitute a modern material such as butyl rubber for natural rubber inner liners of previous tubeless tires. The three judges referred briefly to the work of John B. McGay of Tulsa, Okla., in the field of tubeless tires early in World War II. Mr. McGay showed how to make tubeless tires before Frank Herzegh did, the decision added. Mr. Herzegh was the inventor of the Goodrich tire.

Discussing Goodrich's commercial success with the tire, the court held this was due to improvements in the product. First tires made under the Herzegh patent were not successful and required adjustments, the judges said.

Goodrich's claim of commercial success with the tire has no merit, they said. Goodrich withheld comment on the decision pending arrival of the written opinion. The company has a similar suit pending in Cleveland Federal Court against Firestone Tire & Rubber Co.

## Appointments at Mansfield

► Mansfield Tire & Rubber Co. has announced a number of appointments in its sales and engineering staffs. Paul C. Taylor, director of engineering, has been named factory manager of the company's plant at Oakland, Calif. Robert M. Kallgren, former plant engineer, has been named director of engineering as Mr. Taylor's successor at the Mansfield, Ohio plant. In the Sales Division, J. D. Barr has been appointed factory sales manager of the Inland Rubber Corp., wholly-owned subsidiary of Mansfield Tire. Roger D. Steinebrey has been appointed manager of Chain Store Sales in Mansfield Tire's Special Accounts Division, as successor to H. G. Culbertson who has retired.

## A-P-D Appoints Two New Vice-Presidents

W. A. McGee

R. E. Tisch

► Two vice-presidents have been named for A-P-D Co., Minneapolis, Minn., recently-organized affiliate of Minnesota Rubber and Gasket Co. The new executives are Richard E. Tisch, promoted to vice-president in charge of product development, and W. A. McGee, named vice-president in charge of materials development. Both men have been associated with Minnesota Rubber and Gasket Company. A-P-D Co. began operations January 1 as a centralized organization that would perform applied research for industry in general as well as for its parent company. Current A-P-D activities, include research and development projects for independent research companies and for government agencies.

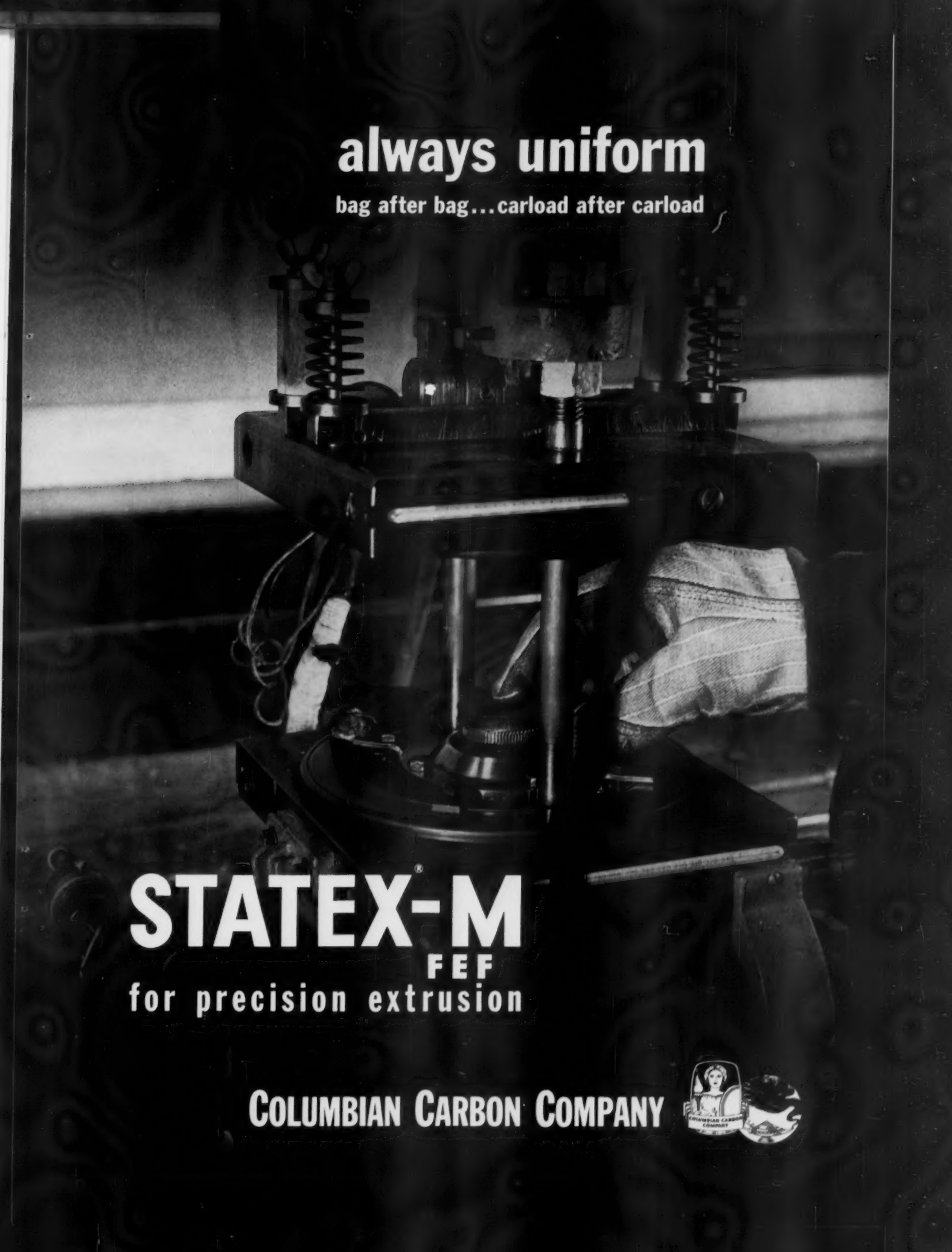
Although much of its work is in the growing field of rubber and rubberlike components for industry, the A-P-D president said the firm's facilities have been expanded to take in the broad field of industrial applied research, including such new techniques as work with radioactive materials. Mr. Tisch, who has been manager of Minnesota Rubber's Product Development Engineering Department, joined the firm in 1956. He had previously been senior test engineer and supervisor of the hydraulic and electro-mechanical engineering test laboratory for Bendix Aviation Corporation's Pacific Division. Prior to that he was associated with Northrop Aviation Company. He is a member of the Society of Automotive Engineers and of Alpha Sigma Phi. Mr. McGee, a native of Fairmont, Minn. and a graduate of the University of Minnesota, left General Motors Corporation in 1950 to join Minnesota Rubber. He has held a number of posts in its research organization.

## Rigidsol Plastisol

► Watson-Standard Co., Pittsburgh, Penna., has developed a series of rigid plastisol compounds from which harder and more durable plastisol products may be made. These compounds, known as "Rigidsol", are low plasticized vinyl dispersions which are furnished as one-package, low viscosity free-flowing liquids. Upon heating to 350-400°F., they are converted to a tough rigid, non-brittle elastomer. A complete line of Rigidsols are available which produce hardnesses as high as 60 on the Shore "D" Durometer scale. Processors find Rigidsol a highly versatile material with which to work, Watson-Standard officials state. This product maintains excellent viscosity stability on aging and can be used in rotational molding, slush molding, spread coating and casting applications. The versatility of Rigidsol is further illustrated by the variety of end products which can be made. The application of this compound to the improvement of current products or the creation of new products is limited only by the imagination of the user. Products which are presently being produced with Rigidsol included anatomical models, boat bumpers, life rings, etc.

## Plant Addition Completed

► Construction of a plant addition to house the companies' general engineering and methods engineering departments as well as the newly organized development engineering section, has been announced by the Sinclair-Collins Valve Co. and the Valvair Corp. According to W. F. Kruspe, executive vice-president, increased sales volume and intensification of the companies' product research and development programs created the need for the new addition. To be shared by the two companies, the new facilities in Akron, Ohio, include approximately 6,000 square feet of office and testing laboratory floor space. General engineering and methods engineering will occupy half of the new area. The development engineering section, recently organized as a separate department, will be located in the remaining portion. In addition to office and drafting room space, development engineering facilities will include separate testing laboratory rooms for air and vacuum, electrical, hydraulic and steam tests, as well as a sound-proof breakdown test room. Redesign of the plant exterior and addition of a new reception room, lobby and conference rooms are included in the current program.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## Factory Management Changes

► Important changes in the factory management organization of the Goodyear Tire & Rubber Co. have been announced by Russell DeYoung, executive vice-president. W. S. Wolfe has been appointed director of domestic production, responsible to Mr. DeYoung. W. H. Rudder is now manager of domestic tire production, responsible to Mr. Wolfe. Reporting to Mr. Rudder will be the managers of the Jackson, Mich.; Gadsden, Ala.; Topeka, Kan., and Los Angeles, Calif. plants and the Akron general superintendent.

J. E. Stafford has been appointed manager of industrial products production, and also is responsible to Mr. Wolfe. Reporting to Mr. Stafford will be the managers of the Windsor, Vt.; New Bedford, Mass.; St. Marys, Ohio; Lincoln, Neb., and North Chicago, Ill. plants. Continuing to report to Mr. Wolfe will be H. I. Belknap, manager of chemical products production; W. K. Wilder, manager of Goodyear fabric mills, and C. H. Maxwell, manager, plant "C" Akron.

R. A. Jay, manager, engineering, has been assigned the additional responsibilities for the functions of plant planning and methods and machine design. Reporting to Mr. Jay will be R. E. Lee, manager, plant planning and methods; H. C. Clark, manager, machine design, and W. H. Tyson, manager, engineering staff. Mr. Jay will report to executive vice-president DeYoung.

Leroy Tomkinson, general superintendent, has been placed in charge of Akron production operations, established as a plant unit. He reports to Mr. Rudder. Reporting to Mr. Tomkinson are R. C. Helwig, superintendent, industrial products; J. Q. Shaul, superintendent, Plant 2 tires and reclaim; D. E. Hill, superintendent, metal products; Marvin Huffman, superintendent, Plant 1; P. L. Young, division foreman, fuel cells, Pliocells and cement house; A. B. Kibble, division foreman, production control, stores, receiving and general service functions; E. F. Pierce, superintendent, plant maintenance.

F. L. Coburn, division manager, transportation, returned goods and by-products, and T. G. McBrayer, building superintendent and manager, janitor service, report to Mr. Kibble.

## U.S. Sues Goodrich Demanding Disclosure on Formula for Natural-Like Synthetic

### Goodrich Answers: *"There is no justification whatsoever for the Government's claim."*

► The Department of Justice filed an action in Federal District Court in Washington, D. C., on May 8 demanding that the B. F. Goodrich Co. disclose full information on its formula for a synthetic rubber described as chemically the equivalent of natural. The department said its purpose was "to make this new and valuable process available to the entire rubber industry" in this country.

The suit claimed the new process was developed by Goodrich with Government money. Goodrich was one of several concerns paid to do synthetic rubber research under a Government program set up when Asian sources of natural rubber were cut off during World War II. Goodrich was paid more than $1,700,000 for its research between 1949 and 1955, the Government asserted.

According to the suit, when Goodrich took on the job it promised to make available to the Government all information on new processes which it might develop, regardless of whether the information resulted from Government-financed research. The Government also claimed Goodrich promised to grant the U. S. a royalty-free license to use such information and disclose it to others.

The suit stated that in December, 1954, Goodrich-Gulf Chemicals Inc., a 50-50 subsidiary of Goodrich and Gulf Oil Corp., publicly announced it had worked out a process for making a product called "cis-1, 4-polymer isoprene."

Goodrich, the Government charged, has asked for U. S. patents on the new process, and a subsidiary has already obtained a Belgian patent on it. The suit added that Goodrich has refused to furnish the U. S. with details of the new process despite repeated requests to do so.

The suit asked the court to find that the Government is entitled to this information, in line with its 1949 contract with the rubber-maker. The court was also asked to find that the Government should get a royalty-free license.

Answering the Department of Justice claim that Goodrich should turn over to the government its process for duplicating the natural rubber molecule, the company issued the following statement:

"The discovery of Ameripol SN rubber was a development of Goodrich-Gulf Chemicals, Inc. and bore no relationship whatsoever to a research contract between the B. F. Goodrich Company and the government. Goodrich-Gulf is owned 50 per cent by Gulf Oil Corporation and 50 per cent by B. F. Goodrich.

"The discovery which the government now seeks to take away from B. F. Goodrich was based upon scientific knowledge purchased by Goodrich-Gulf in Europe in 1954. Although we have not received the complaint which the government has filed against B. F. Goodrich, it appears from a copy of a Department of Justice press release that the government is claiming that we should give this discovery by Goodrich-Gulf Chemicals to our competitors and the government without Compensation.

"It appears from the Justice Department press release that the government is claiming that B. F. Goodrich duplicated the natural rubber molecule while the company had a research contract with the government. It should be emphasized that although the government does not claim that government funds were used in the development of SN rubber, it contends nevertheless that B. F. Goodrich should give this development to its competitors and to the government.

"In the first place, the discovery was made with private funds of Goodrich-Gulf Chemicals, not by B. F. Goodrich, and SN rubber is the property of Goodrich-Gulf Chemicals, Inc. "There is no justification whatsoever for the government's claim."

## Rules on DuPont-GM

► The United States Supreme Court in a 4 to 2 decision has ruled that E. I. du Pont de Nemours & Co., Inc., illegally controls the General Motors Corp. The majority held that 23 per cent of General Motors stock acquired in 1917-19 by DuPont constituted control of the automotive manufacturer in violating of the antitrust laws. The decision reversed a ruling by a lower court. Additional details of the Supreme Court's sweeping decision will appear in the July issue of this journal.

## General Tire Undertaking New Financing Program

► General Tire & Rubber Co., Akron, Ohio, has announced that the company will undertake a new financing in order to keep pace with the company's expanded volume and to maintain its projected growth pattern in several areas of business. General Tire claims that over-all growth has taken place throughout the company and its various divisions and operations. Under consideration is the sale by Aerojet-General of some of its authorized unissued common stock. Aerojet-General sales have increased greatly since 1952 and in the first four months of the 1957 fiscal year, Aerojet-General sales were about 25% ahead of sales for the same period in 1956, the company says. Today, Aerojet-General has better than $570 million in scheduled, but not actually contracted, business over the next three to four years, excluding any new programs which may be initiated. Complete details on the contemplated financings for General Tire and Aerojet-General have been deferred until plans have been crystallized. However, the company has under consideration a total program in the neighborhood of $25 million in the two companies combined.

## Introduces Pliovic S50

► "Pliovic S50", an unmodified polyvinyl chloride resin said to exhibit processing properties characteristic of vinyl copolymers while retaining the physical properties of unmodified resins, has been introduced by the Chemical Division of the Goodyear Tire and Rubber Co., Akron, Ohio. The new resin, which has an inherent viscosity of 0.68, has been designed for applications where vinyl copolymers had formerly been required. Pliovic S50 particles average 40 micron in size, blending readily with other resins for compounding ingredients, the company says. Low viscosity of the resin, previously attainable only with copolymers, furnishes the plastic flow required by producers of injection molded and extruded products. The material may be processed on equipment capable of temperatures of 250° to 300°F. Very little plasticizer is required in compounding the resin and some rigid products have been successfully produced without any plasticizer whatever, according to Goodyear. Pliovic S50 is applicable to the production of rigid and semi-rigid products such as vinyl asbestos flooring, sheeting and high fidelity phonograph records. It can also be utilized as a base polymer in nitrile-vinyl combinations. The material is available in 50 pound multi-walled bags and is priced in the same scale as other resins in the Pliovic family.

Sam Tinsley

## Announces Retirement

► Samuel H. Tinsley, associated with the R. T. Vanderbilt Co. for over 20 years in development work and technical sales and service, retired on June 1. Mr. Tinsley attended the University of Virginia where he received his B. S. and M. S. degrees, and later did graduate work at the Massachusetts Institute of Technology. He was chief chemist for Respro, Inc. in Cranston, R. I. and later development and plant manager for Coated Textile Mills, Inc. in Pawtucket, R. I., prior to joining Vanderbilt in 1937. Mr. Tinsley's retirement results from a heart attack he suffered nearly a year ago and from which he has not fully recovered.

## Elections at 3M

► Election of Joseph C. Duke as executive vice-president in charge of coated abrasives and adhesives and coatings, and Bert S. Cross as executive vice-president in charge of graphic products, has been announced by the Minnesota Mining & Manufacturing Co. Messrs. Duke and Cross were recently elected directors of 3M. The company also announced the election of Dr. Byron J. Oakes as vice-president of the chemical products group, and Cecil C. March as vice-president of the Coated Abrasives and Related Products Division. Mr. Duke, who has been with 3M for 36 years, joined the company as a sales representative. A vice-president since 1948, he has been responsible for the firm's coated abrasives and adhesives and coatings operations for the past two years. Mr. Cross, who joined 3M in 1926 as a laboratory technician, has been responsible for all 3M graphic products since 1953. He has been a vice-president since 1948. Dr. Oakes has been general manager of the chemical products group since it was formed in April of 1955. He joined 3M in 1928 as chief chemist, serving subsequently as manager for waterproof abrasives and general manager of the Central Manufacturing Division. Mr. March has been general manager of the Coated Abrasives and Related Products Division since June, 1955. He joined 3M as a laboratory technician. In 1948, Mr. March was named manufacturing manager for coated abrasives and related products.

## World's Largest Tire

► The world's largest tires, one and a half ton monsters manufactured by the Firestone Tire & Rubber Co., undergo tests in the New Mexican desert before shipment to Saudi, Arabia. Towering nine feet tall, they will soon move complete pumping stations over the Arabian sands. Each tire contains more than a half ton of rubber, 197 pounds of fabric and 27,000 feet of bead wire.

## Cuban Unit Near Completion

► Firestone Tire & Rubber Co., Akron, Ohio, has announced that a new Cuban plant with a capacity of 100,000 tires a year is nearing completion. Located on a 50 acre tract, 15 miles east of Havana, in Cuatro Caminos, the plant will manufacture passenger, truck and off-the-highway tires. Construction crews are now pouring concrete floors and installing the roof on the multi-million dollar structure. The plant is scheduled for completion in October of this year and most of the tire building equipment which will be used has been delivered in Havana and is ready for installation. By establishing this unit in Cuba, the company expects to offer better service to the owners of the 150,000 motor vehicles now on Cuban roads. This will be Firestone's thirteenth plant outside the United States. Another plant is under construction in Manila, Philippines.

## Cab-XL Process Permits Black-Loaded Polyethylene

► Research and Development Department of Godfrey L. Cabot, Inc., Boston, Mass., has announced the discovery of the "CAB-XL" process, said to make possible an entirely new range of applications for polyethylene and other plastics. The process permits new compositions of matter in which finely divided pigments and polymers are combined in an especially effective manner. Carbon black loadings can be used to an extent previously regarded as impossible, which results in greater strength. In the past, the use of carbon black in plastics has been restricted to small amounts for coloring and to protect against degradation from sun and weather. High loadings of carbon black has not been practical because it resulted in excessive embrittlement.

The company claims that CAB-XL-polyethylene compositions containing 50 per cent and more carbon black remain flexible, even at extremely low temperatures. Two of the most serious limitations of plastic, creep and fracture, are virtually overcome, the company says. At Cabot laboratories, polyethylene pipe continuously fabricated and using a CAB-XL composition containing 100 parts of carbon black exhibited resistance to stress cracking, improved high temperature behavior, virtual elimination of plastic flow and improved resistance to deterioration by solvents and oils. Tests indicate that burst strength has been doubled both at room temperature and elevated temperatures, according to Cabot. In addition, substantial savings are said to be made possible by the use of large quantities of low cost carbon black.

## Forms Air Spring Department

► A new $1 million department for the manufacture of rubber air springs for the automotive industry has been announced by the General Tire & Rubber Co., Akron, Ohio. The new department will function as part of General's Industrial Products Division in Logansport, Indiana. "Special equipment for the manufacture of our air springs is currently being installed at Logansport, and actual production will begin soon," company officials stated.

## Rubber Shipping Pact Gets FMB Support

► The practice of a group of steamship companies of pooling rubber shipments from Thailand to the United States has been defended by Federal Maritime Board Examiner C. B. Gray. In a recommended decision, Mr. Gray said that the participation of two subsidized American steamship lines in the pooling agreement has not been shown to "contravene the purposes, policy or provisions of the Merchant Marine Act. The pooling agreement has effectually terminated the rate cutting practices," Examiner Gray noted, and went on to point out that "no line has complained that it is not getting its fair share of rubber."

The agreement, Mr. Gray said, "represents the expressed willingness and proven ability of three United States' flag carriers and nine foreign lines to work together harmoniously and equitably participate in the important Siam to U. S. rubber trade." He also commented that the agreement appears to "have removed the possibility of disruption of the Malayan and Indonesian trades."

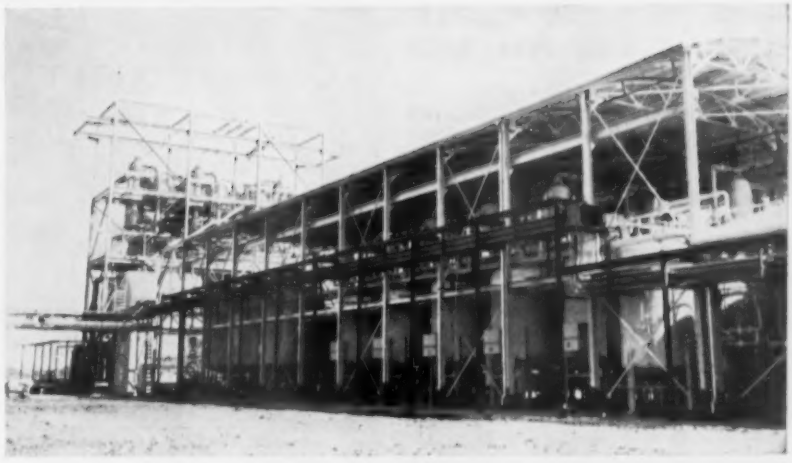
The American companies participating in the pool are American President Lines, Lykes Bros. Steamship Co. and the Isthmian Line. APL has a 17 per cent allotment; Isthmian, 12.5 per cent, and Lykes, 5 per cent.

## Quaker Promotes Joyner

► The appointment of James H. Joyner as general manager, Pioneer Works, Quaker Rubber Division, H. K. Porter Co., has been announced by G. A. Dauphinais, vice-president and general manager. Mr. Joyner's duties will include supervision of accounting, manufacturing, production, general plant operations, and sales. He will report to Mr. Dauphinais. Mr. Joyner joined Quaker as a sales representative covering South Carolina and eastern Georgia in 1950. He has since set up Quaker branches in both St. Louis and Los Angeles. He spent two years as district manager in Los Angeles, supervising Quaker sales in a seven state area, prior to the purchase of Pioneer Rubber mills by H. K. Porter. When Porter acquired Pioneer, Mr. Joyner was made manager of sales in the ten western states. Before joining the Quaker Rubber Division, Mr. Joyner was employed by the Department of Justice as a Special Investigator.

## Modernizing Baytown Plant

► A $650,000 modernization program is planned by United Rubber and Chemical Co. at its Baytown, Texas, synthetic rubber plant. Plans call for addition to and modernization of existing plant facilities, new concrete and metal buildings, process piping and insulation work, mechanical work and power and electrical work. United Rubber, a subsidiary of United Carbon Co., Charleston, West Va., bought the plant from the government for more than $8,500,000. The plant has a rated annual capacity of 44,000 long tons of synthetic rubber.



Heart of the expansion which gives a 50 per cent rated capacity increase in production to Goodyear Tire & Rubber Company's Houston synthetic rubber plant are the two lines of new reactors. Each line contains 11 reactors of 5,000 gallon capacity. Recovery area, consisting of three new stripping columns, towers above reactor building which is shown in the foreground.

## Goodyear Completes Expansion Program at Houston

► Goodyear Tire & Rubber Co. has announced completion of an expansion program costing nearly $10 million which will boost production capacity of Plioflex rubbers at the company's Houston, Texas, synthetic plant to 220,000 long tons a year. With this 50 per cent rated capacity increase, Goodyear's Houston plant thus becomes the world's largest single producer of dry type synthetic rubbers. Completion of the expansion program comes just two years after purchase of the plant from the Government (April 28, 1955) and is indicative of the great progress made by private ownership and operation of the plant.

Heart of the $10 million expansion was the construction of two completely new reactor lines, each containing 11 reactors of 5,000 gallon capacity each, and a new recovery area with three new stripping columns. Also included in the expansion program are spherical butadiene blend tanks of 210,000 gallon capacity each, which make possible a seven-fold increase in storage capacity of butadiene, one of the major raw materials in synthetic rubber.

Styrene storage capacity also has been increased proportionately and together these new storage facilities enable the plant to turn out larger quantities with the assurance of more uniform quality. A new materials preparation building makes possible more efficient use of manpower and will contribute to new economies in plant operation. Instruments and controls in the expanded facilities are more centralized and allow more accurate control over the production process at every stage.

Another important part of the expansion is a new and larger final process or finishing building containing four drying units, each three stories high. Also included in this building is an additional 37,000 square feet of warehouse storage space. Warehouse space at Goodyear's Houston synthetic plant now totals more than 117,000 square feet and more than 17 million pounds of Plioflex rubber can be stored at one time. Goodyear was the first of the private rubber producers to announce expansion plans involving major new construction after the synthetic plants were sold by the Government. During the past two years under Goodyear ownership and operation, the plant has instituted a number of improvements in processing and equipment, resulting in increased production and improved products without any increases in price.

During these same two years, the plant has turned out 641,574,518 pounds, or 286,417 long tons of Plioflex rubbers for the rubber industry. These include hot, cold and oil-extended general purpose synthetic rubbers of the GR-S type. With the expanded production facilities now on stream, a basic line of eight different types of Plioflex rubber are being produced.

The plant not only supplies rubber for Goodyear's plants worldwide but meets the requirements of numerous other manufacturers and processors in the rubber industry and associated fields.

In addition to the Goodyear program, the expanded butadiene production facilities of the Petro-Tex Chemical Corp. at Houston have also been put in operation. This expansion, together with other modifications that have been made in the plant, increases the capacity from 90,000 to 200,000 tons of butadiene a year. Petro-Tex is jointly owned by the Food Machinery and Chemical Corp. and the Tennessee Gas Transmission Co. The company was formed two years ago to operate a plant purchased from the Government. The Petro-Tex plant is adjacent to Goodyear's synthetic rubber plant and it supplies butadiene to it is well as other synthetic rubber plants.

## Hunter Speaks on Modern Blowing Agents

► "The Chemistry and Application of Modern Blowing Agents" was discussed by Dr. B. A. Hunter, Naugatuck Chemicals Division, U. S. Rubber Co., before the Joint Meeting of the Wellington-Waterloo Section, C.I.C. and the Ontario Rubber Group on March 12 at the Royal Hotel in Guelph, Ont., Canada. In his address, Dr. Hunter pointed out that the technology of producing expanded rubber and plastics has been significantly advanced in recent years by the development of a number of organic nitrogen compounds which decompose at elevated temperatures to release a blowing gas (generally nitrogen). The more acceptable materials, he said, are nondiscoloring and produce little or no odor in the expanded product.

The speaker went on to say that the organic blowing agents now available cover a range of decomposition temperatures and permit the expansion of rubber and plastics according to a variety of processing techniques. Literature containing suggestions on the best mode of use can generally be obtained from the supplier, he said.

Dr. Hunter then listed a number of chemicals presently produced as nondiscoloring blowing agents in the United States, and analyzed each as to chemical composition and performance. He noted that several of the materials he discussed are also available under different designations from agencies in Great Britain and Europe.

## Cooper Tire Claim Denied

► The United States Court of Claims at Washington, D. C., ruled on April 8 that the Cooper Tire & Rubber Co., Findlay, Ohio, has no legal or equitable claim against the government for $1,811,333 that the company claims to have lost under seven government contracts. The Army Contracts Adjustment Board turned down the company's claim on grounds the contracts for tires, tubes and camelback for the Army contained no escalator clauses protecting the contractor from higher costs which occurred with the outbreak of the Korean War. The court said that the decision was harsh but "we are without authority to review such decision". It said, it is up to Congress to decide if Cooper can be reimbursed.

## Buffalo-Ontario Meeting

► The 16th Annual National Meeting of the Buffalo Rubber Group and the Ontario Rubber Section of the Chemical Institute of Canada was held on May 10 at the Sheraton-Brock Hotel in Niagara Falls, Ont., Canada. Principal speaker of the meeting was Dr. E. R. Rowzee, executive vice-president of the Polymer Corp., Sarnia, Ont., who delivered a paper entitled "Outlook on Rubber For Tomorrow." Dr. Rowzee's address concerned itself with technical, economical and political aspects. A suppliers' cocktail party preceded the dinner.

## Coming Events in the Rubber Industry

**June 16-21.** A.S.T.M., Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

**June 21.** Akron Rubber Group, Summer Outing, Firestone Country Club, Akron, Ohio.

**June 28.** Detroit Rubber & Plastics Group, Western Country Club, Detroit, Mich.

**July 26.** Chicago Rubber Group, Golf Outing, Medinah Country Club, Medinah, Ill.

**Aug. 1.** New York Rubber Group, Golf Outing, Baltusrol Golf Club, Springfield, N. J.

**Aug. 16.** Philadelphia Rubber Group, Golf Outing, Manufacturers' Country Club, Philadelphia, Penna.

**Sept. 7.** Connecticut Rubber Group.

**Sept. 11-13.** Division of Rubber Chemistry, A.C.S., Fall Meeting, Hotel Commodore, New York, N. Y.

**Sept. 23-25.** A.S.M.E., Fall Meeting, Hotel Statler, Hartford, Conn.

**Sept. 26.** Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

**Oct. 1.** Los Angeles Rubber Group, Biltmore Hotel, Los Angeles, Calif.

**Oct. 4.** Detroit Rubber & Plastics Group, Detroit-Leland Hotel, Detroit, Mich.

**Oct. 4.** New York Rubber Group, Henry Hudson Hotel, New York, N. Y.

**Oct. 8.** Buffalo Rubber Group, Hotel Westbrook, Buffalo, N. Y.

**Oct. 11.** Chicago Rubber Group, Furniture Club, Chicago, Ill.

**Oct. 18.** Boston Rubber Group, Fall Meeting, Somerset Hotel, Boston, Mass.

**Oct. 24.** Southern Ohio Rubber Group, Fall Technical Meeting, Engineers Club, Dayton, Ohio.

**Oct. 25.** Akron Rubber Group, Fall Meeting, Sheraton-Mayflower Hotel, Akron, Ohio.

**Oct. 25.** Philadelphia Rubber Group, Poor Richard Club, Philadelphia, Penna.

**Nov. 5.** Los Angeles Rubber Group, Biltmore Hotel, Los Angeles, Calif.

**Nov. 15.** Chicago Rubber Group, Furniture Club, Chicago, Ill.

**Nov. 15.** Connecticut Rubber Group.

**Nov. 15-16.** Southern Rubber Group, Memphis, Tenn.

**Dec. 1-6.** A.S.M.E. Annual Meeting, Hotel Statler, New York, N. Y.

**Dec. 3.** Buffalo Rubber Group, Xmas Party.

**Dec. 5.** Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

**Dec. 6.** Detroit Rubber & Plastics Group, Xmas Party, Sheraton-Cadillac Hotel, Detroit, Mich.

**Dec. 10-11.** Society of the Plastics Industry, Sheeting and Coated Fabrics Division Conference, Commodore Hotel, New York, N.Y.

**Dec. 13.** Boston Rubber Group, Xmas Party, Somerset Hotel, Boston, Mass.

**Dec. 13.** New York Rubber Group, Henry Hudson Hotel, New York, N. Y.

**Dec. 14.** Southern Ohio Rubber Group, Winter Meeting, Miami Valley Golf Club, Dayton, Ohio.

**Dec. 20.** Chicago Rubber Group, Xmas Party, Morrison Hotel, Chicago, Ill.

**Jan. 24, 1958.** Akron Rubber Group, Sheraton-Mayflower Hotel, Akron, Ohio.

**Feb. 13, 1958.** Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

**Feb. 21-22, 1958.** Southern Rubber Group, Houston, Texas.

**April 10, 1958.** Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

**April 11, 1958.** Akron Rubber Group, Spring Meeting, Sheraton-Mayflower Hotel, Akron, Ohio.

**May 14-16, 1958.** Division of Rubber Chemistry, A.C.S., Spring Meeting, Netherlands Plaza Hotel, Cincinnati, Ohio.

**June 20, 1958.** Akron Rubber Group, Summer Outing, Firestone Country Club, Akron, Ohio.

**June 22-28, 1958.** A.S.T.M. Annual Meeting, Hotel Statler, Boston Mass.

### Introduces New Tubeless

► A new "Life-Saver Tubeless Tire," styled for modern, longer, lower cars and said to provide motorists with improved mileage, traction and safety has been introduced by the B. F. Goodrich Tire Co., Akron, Ohio. The latest version of the first tubeless tire marketed has been named "B. F. Goodrich Life-Saver Silvertown". It features a new, wider tread with 16 cross-cuts to the inch on two outside ribs on each side. Cross-cuts provide caterpillar action enabling motorists to stop more safely and start faster. Three center ribs consist of molded-in zig-zag kerfs which serve as stabilizers for better steering control and less side-slip on turns in passing. The tread is made of a specially developed compound of crude and synthetic rubber that gives a strong, long-lasting tread, the company says. Made with nylon cord in both the 14-inch and the 15-inch sizes, the new 4-ply Life Saver has been styled for sleek, low, modern cars. The new tire also features puncture-sealing protection. A gummy sealant closes around nail punctures, preventing loss of air. When the nail is withdrawn, the sealant follows it into the hole to provide permanent repair. The tire's nylon cord construction adds strength to the body and protects against bruise breaks. A patented inner liner changes a bruise blowout to what is called a slowout. Air comes out of the tire slowly, enabling the motorist to come to a safe, slow stop.

### Develops Carbopol 934

► B. F. Goodrich Chemical Co., Cleveland, Ohio, has announced the development of "Carbopol 934", which is said to eliminate undesirable properties of stickiness, stringiness and strike-through found in most rubber cements. The material, which is used for thickening or suspending systems containing water, is also efficient in solvent systems and is now being used to thicken alcohol and paint remover formulations, the company says. Recent work indicates that Carbopol 934 may also be used effectively in non-hydrophilic material such as rubber cement formulations. Although not all major types of cements have been evaluated, it has been found that in cement composed of an acrylonitrile rubber, such as Hycar 1042 dissolved in ketones, a smooth, easily spread formulation results.

### Assigned Bakelite Post

► Bakelite Co., New York, N. Y., has announced the appointment of R. P. Bowditch as assistant general product manager to work with Dr. C. M. Blair, product general manager, polyolefins, in the coordination of the corporation's program in polyethylene and related products. Mr. Bowditch received a degree in mechanical engineering from the University of Illinois. He joined Union Carbide Corp. in 1935 at South Charleston, West Va. serving in the Concentrates Raw Materials Department until 1943. Later, Mr. Bowditch became area supervisor of polyethylene production and in 1952, he was named assistant director of the Gas Process, Engineering and Development Department.

E. C. Brown, Jr.

### Joins New York Office

► Appointment of E. C. Brown, Jr. to the New York City office of the Chemical Division of the Goodyear Tire and Rubber Co. has been announced by C. O. McNeer, general sales manager of the division. Mr. Brown will assume the field duties of J. Drexler who recently was transferred to the Goodyear International Corp. With headquarters in New York City, Mr. Brown will service rubber and plastic processing companies in that area. Mr. Brown joined Goodyear in 1954 with more than 15 years experience in the rubber and plastic industries and for the past three years had coordinated sales service activities for the Plastics Department in Akron. He is a graduate of Montana State College.

### Epoxy Paints Brochure

► Thiokol Chemical Corp., Trenton, N. J., has announced the availability of a new leaflet illustrating the added properties of epoxy paints when modified with liquid polymers. This brochure, entitled "Epoxy Paints Have Wider Applications . . . Longer Life . . . With Thiokol Liquid Polymer", contains a sample metal strip sprayed with an epoxy/Thiokol liquid polymer to illustrate its improved resistance to chemicals and water; greater impact resistance; and the enamel-like, one-coat application made possible. It is claimed that epoxy paints have good adhesion, longer life, lower cost. Thiokol has also prepared a technical brochure with suggested formulations of epoxy/liquid polymer paints for marine, aircraft, industrial maintenance, and railroad car applications. These materials are available, upon request, from Thiokol at 780 North Clinton Ave., Trenton 7, N. J.

### Quel-Spray Plastisol

► A new polyvinyl chloride plastisol that can be sprayed on cold vertical metal surfaces as a protection against chemical corrosion has been announced by Quelcor, Inc., Chester, Penna. The new plastisol, called "Quel-Spray", is particularly useful in applying chemically resistant coatings to metal parts and structures which cannot be conveniently dip coated. Quel-Spray is a true plastisol and has many distinct advantages over PVC sprays which are modified plastisols and organisols, the company states. Quel-Spray requires no thinner, can be left in the gun overnight and loses no thickness from wet to dry film when cured at approximately 350°F.

## Advises Against Alcohol-Butadiene from Grain Program

► Comptroller General Joseph Campbell has advised Congress against approving a large-scale program to produce alcohol butadiene from grain. In a letter to the Senate Banking Committee, Mr. Campbell hinted that the program was not only unnecessary but contrary, as well, to the Government's policy to let private industry manufacture synthetic rubber.

Under the 1953 Rubber Facilities Disposal Act, the government has disposed of all but one of more than 25 synthetic rubber plants. Under the Douglas-Curtis bill commented upon by Mr. Campbell the government would inaugurate an "experimental program for manufacturing butadiene from alcohol . . . for the purpose of demonstrating the commercial feasibility and ascertaining the costs of such production."

Mr. Campbell said the commercial feasibility of producing butadiene from both alcohol and petroleum was proved out while the synthetic rubber plants were still in Government hands. Costs of production were kept for each type of operation, he added.

"These costs," he pointed out, "indicate that butadiene was produced from alcohol at substantially greater costs than that produced from petroleum. In the light of this background, your committee may wish to consider whether a new experimental program for that purpose is necessary," Mr. Campbell stated.

The Douglas-Curtis bill, sponsored by Senators Paul Douglas (Dem., Ill.), and Carl Curtis (Rep., Neb.), would implement a recent proposal of the Presidential Commission on New Uses for Farm Products. Though failing to give the plan official commission indorsement, the group informally suggested the possible employment of 10 idle alcohol plants and two idle butadiene plants to consume millions of bushels of grain annually. The butadiene produced, the commission said, could be used to meet current and expected demands of the rubber, paint and plastics industries without displacing present civilian output.

Mr. Campbell also criticized the Douglas-Curtis bill's provision for operating the program on a revolving fund basis. "We believe that the program, if approved, schould be financed by direct appropriation and that any receipts should be deposited into the Treasury as miscellaneous receipts", he said.

# NSIA Holds Rubber Symposium in Washington, D. C.

## *A step toward improving communications between the industry and the Defense Department*

► Details of a Symposium on Rubber and Plastics sponsored by the Rubber and Plastics Advisory Committee of the National Security Industrial Association in Washington, D. C., on December 11 and 12, 1956, have now been made available in the form of a special report. The symposium was organized with the cooperation of the Office of the Assistant Secretary for Research and Development, Department of Defense, as the first step toward improving communications between the department and the rubber and plastics industry.

Brought about by the increased need for a more specialized information disseminating service, the meeting was held to review past work in high polymers, possible future specifications to be imposed on rubber and plastics by military requirements and also to predict the most promising lines of research. Speakers with broad experience in rubbers and plastics discussed the demands which Military developments might make within the next decade for new and improved rubber and plastic materials. It was hoped that the discussions would establish closer coordination between efforts of industry and defense agencies in the field of materials development.

### *Meeting Purpose Defined*

During the first session of the conference, speakers introduced, generally, overall purposes of the meeting and the means by which this particular group of experts could help to solve problems confronted by the rubber and plastics industries in the development of materials suitable for current and future weapons. It was pointed out that representatives of contractors could provide first-hand knowledge of some of the materials problems they had encountered, or expected to meet, in the development of weapons. Representatives of rubber and plastics materials suppliers could describe present work in the field that might contribute to the solution of these problems. The second session of the conference dealt with rubber and plastics in the air.

Brigadier General M. C. Demler, Deputy Commander for Research and Development in the U. S. Air Force, in a talk entitled "U. S. Air Force Requirements for Rubber and Plastic Materials" discussed the abuses that high speeds and high temperatures impose on materials and problems involved in meeting current and future demands of air vehicles. According to General Demler, materials limitations have become a most serious obstacle to aeronautical development. He suggested that a broader picture of air force demands on materials might be gained by a review of ARDC's Technical Program Planning Documents, which cover thirty-six areas, including materials, development, aeronautics, propulsion, etc., and give detailed analyses of present capabilities, proposed possibilities and future requirements of specific technical program areas. These documents, he went on to say, represent the best thinking on where the Air Force stands today and its needs for tomorrow in each of the technical areas discussed.

Rear Admiral J. H. Sides, USN Deputy Special Assistant to the Secretary of Defense for Guided Missiles who discussed "Rubber and Plastics and our Missiles" enumerated some of the applications that rubber and plastics had already found in the production of guided missiles. He pointed out that further industrial developments of both rubber and plastics would greatly assist the guided missile program.

The next paper, "Plastics In The Air", by J. M. Eversole, vice-president and director of research in the Bakelite Division of Union Carbide and Carbon Corp., New York, N. Y., listed some of the contributions that can be made to the development of aircraft by the plastics industry.

"Rubber and Plastics in Aircraft Today and Tomorrow", by G. E. Hughes of the Seattle Division of the Boeing Aircraft Corp., divided military aircraft requirements into three phases. Phase I defined requirements for present day aircraft and missiles. Phase II described requirements for aircraft and missiles being designed today and which will be flying sometime between 1960 and 1965. Phase III covered requirements for aircraft and missiles under study at the present time. Required standards for each phase were enumerated to the group.

Mr. Hughes then discussed materials available at the present time and the applicability of these materials to the requirements listed. He said that the capability of rubber and plastic materials to meet today's and tomorrow's requirements does not seem to be too optimistic. Present standards have not been completely met by materials currently available. He added, however, that a pessimistic view of the situation was unjustified as many materials in use today, meet standards once believed to be impossible to achieve.

Mr. Hughes urged that a greater effort be expended in basic research to develop improved polymers that would lead to improved rubbers and plastics. He also urged that these materials be developed well in advance of the time that they would be put into actual use in order that the Air Force might learn to design adequately with these materials and reduce high replacement or redesign costs.

Norman B. Miller, head of the Rubber, Plastics and Electronics Group in the Materials Engineering Section of the Glenn L. Martin Co., in a talk entitled "Future Needs in the Airframe Industry for Plastic and Elastomeric Materials", said that during the present decade, speeds have tripled and altitudes doubled as powerful jet, ramjet and rocket engines have been developed. Even more rapid advance is anticipated in the future. Mr. Miller outlined some of the materials requirements for future aircraft and missiles. He said that most of present research in aircraft materials is still directed toward the overcoming of the thermal barrier. Some solutions to the high temperature materials problems that are under current investigation were enumerated. One method mentioned was the use of improved materials, which concerns research programs and the development of non-metallic materials.

### *Current Applications*

Mr. Miller then discussed current applications of elastomers and future aims in their utilization. Discussing elastomers and plastics in a nuclear environment, Mr. Miller said that elastomers are by far the worst performers in the radiation field. He added that inhibitors can be incorporated into rubber compounds although much remains to be accomplished in this field. Mr. Hughes stressed that better communication between industrial, educational and governmental agencies must be set up.

H. J. Osterhof, director of research at the Goodyear Tire and Rubber Co., in a paper entitled "Recent Synthetic Rubber Progress", discussed some of the recent progress in this field. He described recent advances in the field of synthetic rubber, such as GR-S, head-to-body-rubbers, butyl tires, synthetic natural rubbers, copolymers, terpolymers, etc. Mr. Osterhof said that it was presently impossible to predict what would happen during the next couple of years. The many advances made during the past two years, he said, have still only scratched the surface. He stated that horizons of materials developers have been widened by new concepts of catalyst and initiator systems and the possibility of radiation-induced reactions. He also spoke of some of the new rubbers reaching commercialization from his own laboratories and pointed out that unquestionably even more new rubbers are under research in other rubber laboratories.

In the third session which dealt with rubber and plastics on the sea, Captain B. F. Bennett, head of Material Development, R & D, Bureau of Ships in the U. S. Navy, spoke on "Plastics and Rubber at Sea." Captain Bennett said that polymeric materials are particularly attractive for sea-going applications because, in general, they resist corrosion, rot, and attack by marine organisms. He stressed that strong, cheap, fire resistant resins for use in reinforced plastic structural applications were needed and that there was also a need for improved reinforcing materials and good technical data on reinforced plastic in all good types of construction.

Captain Bennett said that plastics and elastomers have a great potential for solving many of the Navy's materials problems, especially if designers could be provided with good, handy design data and a simple, trustworthy means of inspection and quality control. He then listed some of the current uses of elastomers and plastics as well as some future applications if the proper materials can be developed.

In the next paper, "Rubber in the Nuclear Air Age," Dr. Richard G. Bauman, director of Nuclear Studies for the B. F. Goodrich Co., said that the navy is on its way to becoming a nuclear powered service. Heat, damaging fluids and nuclear radiation were cited as major problems to the rubber and plastics industries to meet requirements of nuclear powered aircraft, which would soon be a reality, Dr. Bauman said. He discussed some of the effects of nuclear radiation on present rubber and synthetic rubber materials.

### *Curbing Radiation Damage*

Dr. Bauman stated that research programs recently carried out indicated that certain organic materials which were often not outstanding antioxidants or Antiozonants, called anti-rads, were quite effective in delaying the radiation damage of elastomers. The best anti-rads out of 91 studied, retained from 65 to 87 per cent of the original ultimate elongation as compared with 18 per cent for the control sample, a well compounded tread stock containing a normal amount of age resistor. Dr. Bauman said that it appeared that the best anti-rad will provide adequate protection against radiation damage to a dose of 500 megareps.

According to Dr. Bauman, combined damage of heat and radiation are still severe and improved anti-rads are required. To meet this need, research on heat resistant and radiation resistant rubbers will be brought together so that elastomers of the future will combine these two properties. Finally, Dr. Bauman said, improved rubbers are being fabricated and soon will be tested as actual components operating in the same severe environment as they will meet in service.

In "Marine Applications of Reinforced Plastics—Present and Future", James S. Lunn, president of Lunn Laminates, Inc., discussed marine applications of reinforced plastics. Mr. Lunn said that the Navy has been interested in and has investigated reinforced plastics for marine applications for ten years. Many successes had been achieved in this field, he said. However, Mr. Lunn added, some of the most recent successes had not yet been standardized.

"Plastics on the Sea—Problems and Prospects", by H. K. Nason, vice-president, R & D, Monsanto Chemical Co., listed some of the requirements that plastics should meet such as permanence, improved electrical characteristics, resistance to heat radiation damage and chemicals. He pointed out that entirely new concepts of molecular structure would be needed if the desired operating conditions were to be attained. He also pointed out the need for the stimulation of fundamental research in entirely new areas. Mr. Nason urged the continuation of government financed research under the current policy of the Department of Defense. This provides that the government receive royalty-free license to make and use new developments or to have them made for its own use, while contractors making new inventions retain titles for commercial use.

In the fourth session, which covered rubber and plastics on the land, Dr. J. L. Martin, director of Ordnance Materials Research Office, Watertown Arsenal, was the first speaker. In a talk entitled "Materials for the Future Army with Emphasis on Rubber and Plastics", Dr. Martin listed some of the uses for rubber in the army of today. He cited areas in which improved elastomeric and plastic materials may be used. Dr. Martin also discussed some of the requirements that these materials must meet. Increased heat resistance, improved fuel and chemical resistance and increased resistance to radiation damage were named as some of the more important properties to be attained in the compounding of materials.

The next paper, entitled "Plastic Materials & Fabrication: Some Significant Developments", was delivered by Dr. W. C. Goggin, manager of Plastics Technical Services of the Dow Chemical Co. Dr. Goggin discussed four new and important developments, which he believed were of real value in both civilian and military applications. The new developments were the foamed-in-place system; new crystalline polymers based on new heterogeneous catalyst systems; recent work on isotactic crystalline polystyrene and high molecular weight polyolefins; and ionizing radiation of plastics. Dr. Goggin said that these new developments served to indicate some of the new, valuable things that are coming forth from research and development laboratories. He closed by saying that many more new developments are anticipated.

"Tires For The Airplane of Tomorrow", by Dr. F. W. Stavely, director of Chemical and Physical Laboratories of the Firestone Tire and Rubber Co., states that the tire for the plane of the future will be constructed from wire cord. Dr. Stavely said that the wire cord tire will overcome the thermal limitations of organic fibers and yet provide the necessary strength at elevated temperatures. Limitations on tire performance, he said would be greatly influenced by temperature developed during flight, time of exposure and the temperature of the tire on landing.

He stressed that the more promising polymers must be made available in sufficient quantities to determine how they should be compounded, processed and used to construct tires. He discussed recent research sponsored by the Air Force, saying that it appears that the preparation and compounding of elastomers into tires that will perform adequately at elevated temperatures is equally as important as the preparation of polymers which are thermally stable at these temperatures. Dr. Stavely also said that modest improvements in end product performance at elevated temperatures can be obtained with elastomers already available. In closing, Dr. Stavely said that with the polymers now at hand, airplane tires should be cooled to about 250°F. before a landing is made.

"Yes, it seems to fulfill that requirement!"

# Names in the News

**Dr. E. M. Kipp,** previously director for one of the research divisions of Aluminum Co. of America, has joined Foote Mineral Co. as director of research at the company's Research and Development Department at Berwyn, Penna.

**Henry J. Fine,** factory manager of I. B. Kleinert Rubber Co., has received the Morris H. Palmer Memorial Award from the Queens County Management Club "for his outstanding performance in business, welfare and civic activities".

**Oliver F. Redd,** former director of technical service for the Patterson Foundry and Machine Co., has joined the Dravo Corp. as technical service consultant in the Process Equipment Department.

**John J. Keville,** previously general manager of the Standard Plastic Products Division of the Standard Pyroxoloid Corp., has been appointed sales manager for the eastern region of Polymer Chemicals Division of W. R. Grace & Co.

**George P. F. Smith,** associated with the Borg-Warner Corp. since 1938, has been named a vice-president of the Executive Committee.

**Donald H. Lyons** has been named director of purchasing for the Johns-Manville Corp. succeeding W. R. Reynolds, who has retired after 44 years with the company.

**Frank W. Silva,** formerly director of Geon do Brasil, has been appointed technical service manager of associate company relations for the B. F. Goodrich Chemical Co., providing technical service to the company's associate firms in England, Brazil, Mexico and Japan.

**John Mandel,** analytical statistician at the National Bureau of Standards, has been awarded the Department of Commerce Silver Medal for Meritorious Service in recognition of his "meritorious authorship in the field of applied statistics, and noteworthy achievement in the application of statistical methods in scientific research and testing".

**Daniel P. Shedd,** formerly a technical sales specialist for Monsanto, has joined the Mobay Chemical Co. as a sales development specialist.

**Robert E. Frost,** who received a Ph. D. in chemistry from Harvard University this June, has joined the staff of the B. F. Goodrich Co. Research Center in Brecksville, Ohio.

**B. V. Edmunds,** who joined the company in 1955, has been appointed works manager of the Quaker Rubber Division of the H. K. Porter Co.

**Joseph C. Duke** and Bert S. Cross, vice-presidents of Minnesota Mining and Manufacturing Co., have been elected to the firm's board of directors, raising the board membership to eleven.

**John Grotzinger,** manager of the Electrical Engineering Division of the Goodyear Tire & Rubber Co., has been elected to the grade of Fellow in the American Institute of Electrical Engineers.

**Professor Charles C. Winding,** formerly assistant director, has been appointed director of the School of Chemical and Metallurgical Engineering of Cornell University, succeeding Professor Fred H. Rhodes, who will retire on July 1 as director and as Herbert Fisk Johnson Professor of Industrial Engineering.

**Louis J. Jaworski,** previously product manager of the Industrial Adhesives Department, has been appointed manager of government services for the Chemical Division of the Borden Co.

**Dr. Marion B. Geiger,** general manager of Oldbury Products since November, has been appointed director of general development for the Hooker Electrochemical Co.

**Peter F. Zachares,** former sales engineer with Swepes Tube Corp., has been appointed sales engineer in the New York Metropolitan area for the Process Equipment Division of the Rodney Hunt Machine Co.

**John G. Kronseder,** formerly manager of chemical engineering for International Minerals and Chemical Corp., has been appointed assistant director of process development at Velsicol Chemical Corp.

**C. R. Porthouse,** president and director of several firms, has been elected to the board of directors of Alco Oil and Chemical Corp., succeeding Frank Taplin, who recently accepted appointment as assistant to the president of Princeton University.

**Alex B. Bourquard,** treasurer of the Ohio Rubber Co., a division of the Eagle-Picher Co., has been elected to membership in the Controllers Institute of America.

**William H. Shields,** assistant to the research director of Emery Industries, Inc., has retired after 32 years with the organization.

**Dr. Clifford F. Rassweiler,** president-elect of the American Chemical Society and vice-chairman of the board of the Johns-Manville Corp., has been named to receive the 1957 Honor Scroll of the New York Chapter of the American Institute of Chemists.

John Ware

## Forms Chemical Company

► John Ware, formerly vice-president of the Kenrich Corp., has announced the formation of the Ware Chemical Corp. at 80 Myrtle Ave., Westport, Conn. The new firm will produce a complete line of accelerator dispersions and other specialties for the rubber and plastics industries. Ware Chemical is prepared to supply entire acceleration systems to meet customer requirements. Mr. Ware resigned as vice-president in charge of sales, treasurer and director of Kenrich on April 30.

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**Elwood W. Phares,** who formerly conducted sales development work for the Sales Department, has been named manager of marketing and commercial development for the Velsicol Chemical Corp.

**George Jacobs,** director and treasurer of the Circle Wire and Cable Corp., has been appointed to the additional post of vice-president, administration.

**Samuel S. Auchincloss,** formerly president of the Cleveland Welding Division of American Machine and Foundry Co., has been elected president and chairman of the board of Tracerlab, Inc. succeeding William O. Faxon, who has resigned as president but will continue as consultant.

**Mrs. Martha H. White,** former public relations consultant to the Manufacturing Chemists Association, has been appointed director of public relations for Mobay Chemical Co.

**Donald B. Morgan** has joined the New Orleans, La., district sales staff of the Pennsylvania Industrial Chemical Corp. He has been associated with the company since 1955.

**John V. Eakin,** general manager of the Airflex Division of the Fawick Corp., Cleveland, Ohio, has been elected as vice-president of the corporation.

TIME
has proved
the quality of
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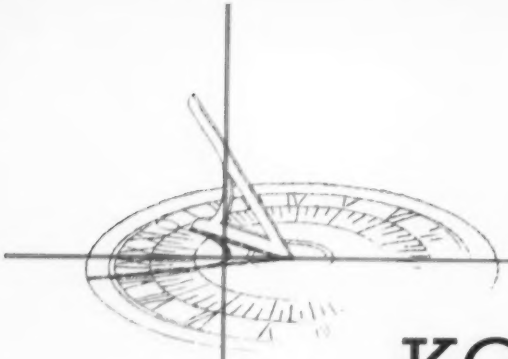
CARBON
BLACKS



# KOSMOS 50

Kosmos 50 is a fast extrusion (FEF) structure black with excellent combination of well balanced properties. It is **the** black for better processing.

Kosmos 50 is the ideal choice for better, smoother and more uniform control on size and dimensional stability of extrusions. It enhances appearance.

Kosmos 50 is a must for black extruded mechanicals. Its use in molded goods is extensive. It is preferred for sub-treads and carcass stocks, and in some grades of tread rubber (camelback).

Standardize on UNITED blacks for established quality and uniformity. They succeed where other blacks fail. Compounders know.

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Robert Walsh

## Named Assistant Director

► Robert H. Walsh has been named assistant director of the Elastomers Laboratories, E. I. du Pont de Nemours & Co., Inc., succeeding the late Dr. Arthur M. Neal who died in April. Mr. Walsh joined DuPont in 1942 as a chemist at the Rubber Laboratory, Deepwater, N. J. He was named a senior research chemist in 1951 and in 1952 was appointed division head of neoprene latex development. In the latter part of 1953 he was assigned to head a fluid systems group on the development of urethane foams. A native of New Brunswick, N. J., Mr. Walsh was graduated from Providence College in 1939 with a bachelor of science degree in chemistry. He also studied at Massachusetts Institute of Technology and Brown University. Prior to joining DuPont, he worked for U. S. Rubber Co. in Providence, R. I. as a development chemist. Mr. Walsh is a member of the Rubber Division of the American Chemical Society, the Technical Association of the Pulp and Paper Industry, Society of Plastics Industry, and the American Society of Testing Materials. He is a member of the Latex Subcommittee of the ASTM Foam Committee and is chairman of the Raw Materials Subcommittee of the Cellular Products Committee, S. P. I.

## 1957 Consulting Guide Released

► The 16th edition of "Consulting Services" 1957 has been published by the Association of Consulting Chemists and Chemical Engineers, Inc., New York, N. Y. Revised and streamlined, the 136 page volume is 6 x 9 inches in size and is priced at $1.00. The book is divided into three major sections. Section I, the *Classifier*, contains over 200 items of activity and members specializing or qualifying in the given field indicated by key numbers, which correspond with the scope pages in Section II. *Scope Pages* describes each member's qualifications and activities. Section III consists of an *Index* in which listings appear alphabetically and geographically. Requests should be made on letterheads, accompanied by a remittance, to ACC & CE Inc., Rm. 82, 50 E. 41st St., New York 17, N. Y.

## Acquires Interest in Englebert

► U. S. Rubber Co., New York, N. Y., has acquired a substantial minority interest in Englebert & Co., one of the oldest and largest tire manufacturers in Europe, located at Liege, Belgium. Through this acquisition, U. S. Rubber will now have facilities available for the manufacture of U. S. Royal tires in Belgium, France and Germany in modern plants favorably located with respect to major European automotive manufacturers and the European plants of American motor companies. Established fifty-four years ago, Englebert & Co. is one of the pioneers in the European tire industry. It operates three plants located in Liege; Aachen, Germany, and Clairoix, France, which are currently being expanded. U. S. Rubber is supplying research and development assistance to Englebert under technical service agreements.

Englebert is the largest tire manufacturer in Belgium and is the principal supplier for General Motors cars assembled there. It is also an important supplier of original equipment tires for the Opel line of General Motors cars manufactured in that country. In France, Englebert supplies original equipment tires to various car manufacturers. In addition to a complete line of tires and tubes for automobiles and trucks, Englebert manufacturers tires for bicycles and other vehicles as well as industrial rubber products.

Charles F. Biggs

## Named Chief Plant Engineer

► Charles F. Biggs has been named chief plant engineer for the Seiberling Rubber Co. succeeding M. S. Cole, who has resigned. Mr. Biggs had been special production coordinator in the Production Division. Since he joined the company in 1946, he also has worked on mat mold design, in engineering and quality control, as plant manager at the Plastics Division in Newcomerstown, Ohio, and as foreman in all departments in the Tire Building Division. Born in Akron, Mr. Biggs attended the University of Akron.

B. R. Teree

## Elected Vice-President

► B. R. Teree has been elected vice-president in charge of engineering and manufacturing of Greer Hydraulics Inc., Jamaica, N. Y. Mr. Teree was formerly chief engineer and manager of engineering and manufacturing of the company. Prior to joining Greer Hydraulics, Mr. Teree was chief engineer of the Weatherhead Co. Aircraft Division and Special Products Division and was director of engineering of the New York Air Brake Company's Hydraulic Division. He has a long record of executive engineering services in the aircraft hydraulic industry.

## Pequanoc Dedicates Plant

► Pequanoc Rubber Co. dedicated its new compounding plant at Tallapoosa, Ga., on May 15. The plant, constructed at an estimated cost of $500,000 will initially employ about 30 persons. The 25,000 square foot plant is located on a 100-acre tract which allows ample room for future expansion. On hand for the Tallapoosa plant dedication were Victor T. Norton, president of the American Hard Rubber Co., parent firm of Pequanoc Rubber, and these officials of the latter company: B. E. Pollak, executive vice-president; F. E. Traflet, vice-president; H. W. Chaudoin, secretary and treasurer; R. J. Love, factory manager, and S. S. Rogers, superintendent of the new plant. Also present were officials of the Bachmann Uxbridge Worsted Corp. and the Wardell Corp. The latter two firms will soon merge with American Hard Rubber to form the Amerace Corp.

## Explosion at Lovell

► An explosion at the Lovell Manufacturing Co., Erie, Penna., which took place on May 8, brought all production activities to a standstill and caused estimated damages of $50,000. Officials say that the figure may go higher, with unofficial estimates going as high as $500,000. An investigation into the cause of the explosion is presently under way, although according to preliminary reports, the cause may never be known. It is believed, however, that a boiler exploded.

# Financial News

### Monsanto Chemical

► Quarter to March 31: Net income of $14,064,000, compared with $12,263,000 in the 1956 quarter. Net sales amounted to $151,285,000, 7.6 per cent above the $140,611,000 for the first quarter of 1956. Capital expenditures this year are expected to reach a record $124,000,000. The company is planning an expansion of its acrylonitrile plant at Texas City, Texas, which would increase the capacity to more than 100,000,000 pounds a year.

### Detroit Gasket

► For 1956: Net income of $279,615, which is equal to 36c a share, compared with $2,062,940, or $2.65 a share, in 1955. Sales in 1956 totaled $39,510,262 compared with $52,369,519 in the preceding year. According to the company, lower earnings resulted from reduced sales, higher labor and material costs and expenses involved in new parts for 1957 passenger cars.

### Pennsalt Chemicals

► Quarter to March 31: Net income of $1,035,500, which is equal to 81c a share, compared with $895,200, or 72c a share, in the first quarter of 1956. Sales in the first quarter of 1957 totaled $19,111,000 compared with $17,256,000 in the same period of the previous year.

### Parker Appliance

► Nine months to March 31: Net income of $1,255,103, which is equal to $2.41 a share, compared with $108,496, or 23c a share, in the corresponding nine month period ending March 31, 1956.

### Okonite

► Quarter to March 31: Net income of $139,589, which is equal to 68c a share, compared with $462,234, or $2.41 a share, in the same period of the preceding year.

### National Rubber Machinery

► Quarter to March 31: Net income of $184,000, which is equal to 94c a share, compared with $174,000, or 89c a share, in the corresponding period of 1956.

### McNeil Machine

► Quarter to March 31: Net income of $984,280, which is equal to $1.64 a share, compared with $743,053, or $1.29 a share, in the same quarter last year.

### Canada Wire

► For 1956: Net income of $1,955,489 compared with $2,037,019 in the preceding year.

### Harshaw Chemical

► Six months ended March 31: Net income of $1,135,122, which is equal to $1.18 a common share, compared with $1,159,159, or $1.21 a share, in the same period of the previous year. Sales in the first six months of the current fiscal year totaled $32,204,970, compared with $32,247,297 in the corresponding period of the 1956 fiscal year.

### Goodyear

► Quarter ended March 31: Estimated net income of $17,265,055, which is equal to $1.66 per share, compared with $13,418,897, or $1.29 a share, in the corresponding period a year ago. Consolidated sales in the first three months of 1957 reached a new high of $353,178,571, compared with $335,270,426, in the same period of 1956.

### American Hard Rubber

► Twelve weeks to March 24: Net income of $351,883, which is equal to $1.00 a common share, compared with $399,184, or $1.14 a share, in the first twelve weeks of the preceding year. Sales in the first twelve weeks of 1957 totaled $7,074,839 compared with $6,829,112 in the same period last year.

### Armstrong Rubber

► Six months to March 31: Net income of $984,214, which is equal to 63c a common share, compared with $854,869, or 55c a share, in the same period of the previous year. Sales in the six month period to March 31 totaled $31,998,761 compared with $28,906,239 in the corresponding period of the previous year.

### Hewitt-Robins

► Quarter to March 31: Net income of $330,574, which is equal to 81c a common share, compared with $291,659, or 71c a share, in the same period of the previous year. Sales in the first quarter of 1957 totaled $15,318,340, compared with $12,330,697 in the corresponding 1956 quarterly period.

### Stauffer Chemical

► Three months ending March 31: Net income of $3,106,000, which is equal to 90c per share, compared with $3,302,000 or 95c a share, in the first three months of 1956. Sales in the first quarter of 1957 totaled $37,048,000 compared with $37,767,000 during the same period last year.

### J. O. Ross Engineering

► For 1956: Net income of $1,239,564, 40% more than the net income of $882,127 in 1955. Sales in 1956 totaled $30,321,227.

### Wyandotte Chemicals

► For 1956: Net income of $4,985,738, which is equal to $2.74 per share, compared with $990,140, or 72c a share, in 1955. Sales in 1956 totaled $79,627,750 compared with $63,058,975. The company's annual report stated that comparisons or earnings with 1955 were not significant since an 82 day strike in that year shut down its major productive facilities. The 1956 earnings were 26 per cent above sales in both 1954 and 1955, and the 1956 operating net earnings of $4,435,738 were twice the average earnings of $2,184,975 in the five years prior to 1955.

### Seiberling Rubber

► Quarter to March 31: Net income of $182,542, which is equal to 31c a common share, compared with $176,168, or 29c a share, in the same quarter of the preceding year. Sales in the first three months of 1957 totaled $10,501,219 compared with $10,716,356 in the same period last year. At the annual meeting of the company, J. P. Seiberling, chairman and president, told shareholders that the year 1957 "may well be the best year of sales and earnings in the peacetime history of Seiberling Rubber Co."

### New Jersey Zinc

► For 1956: Net income of $2,570,650, which is equal to $1.31 a share, compared with $4,826,284, or $2.46 a share, in the previous year. According to the company, peak expenditures for the company's expansion and development program, including heavy mine development expenses on five new mines, were cited as the major reason for depressed earnings. Strikes at the company's smelters, which caused reduced sales volume, were given as a contributing factor.

### General Tire

► Quarter ended February 28: Net income of $3,250,400, which is equal to $1.95 a common share, compared with $2,273,240, or $1.40 a share, in the corresponding period of 1956. Sales in the first quarter of 1957 amounted to $95,497,316 compared with $83,523,606 in the 1956 quarter. Earnings for the first quarter of 1956 do not include earnings of RKO-Teleradio Pictures Inc.

### National Automotive Fibres

► Quarter to March 31: Net income of $553,791, which is equal to 51c a common share, compared with $258,118, or 24c a share, in the same period of the previous year. Sales in the first quarter of 1957 totaled $15,447,758 compared with $14,947,889 in the first three months of 1956.

### General Cable

► Quarter to March 31: Net income of approximately $2,850,000, or about $1 a common share, which is about 30 per cent over $2,188,621, or 91c a share in the corresponding quarter of 1956.

## Activities at Litzler

► Maurice W. Richardson has joined C. A. Litzler Co., Inc., as sales engineer for textile process equipment manufactured by the Cleveland, Ohio firm. A graduate of Lowell Textile Institute, Mr. Richardson also studied mechanical engineering at Rensselaer Polytechnic Institute for a period of three years. He was previously connected with Cleveland Process, Inc., and B. F. Goodrich Aeronautical Division in design and development capacities, as well as with eastern textile processors and equipment builders. His broad experience in fibers, rubber and heating particularly qualify him for application engineering of the continuous web and strand process equipment in which the Litzler firm specializes.

It has also been announced that contracts have been awarded to the Litzler company for the first of two complete high-speed tire cord fabric treating installations at Societe Anonyne des Pneumatiques Dunlop, Paris, France. Ranking with the largest in France, the production systems will represent the most modern design concepts for high efficiency impregnation and preparation of the whole range of tire cord fabrics. Included in the automatic production lines are provisions for equipment which will be required to process fabric types not yet available in France. Output will be channeled to the complete range of tires manufactured by Dunlop of France, from motorcycle size to oversize equipment for large, off-the-road units.

## BWH-Biltrite Merger Official

► The merger of the Boston Woven Hose & Rubber Co. into the American Biltrite Rubber Co., Inc. became effective April 25, 1957 upon the filing of documents in Massachusetts and Delaware, according to Maurice J. Bernstein, president of American Biltrite. Stockholders of the two companies voted approval of the merger at special meetings held April 24. The activities of Boston Woven Hose are being carried on without interruption through a separate division of American Biltrite known as the Boston Woven Hose & Rubber Co. Division, with the former officers of Boston Woven Hose continuing as officers of this division. American Biltrite operates four plants in the United States and Canada.

## Name Changes at Carbide

► The name of Union Carbide and Carbon Corp., New York, N. Y., has been shortened to Union Carbide Corp., effective May 1, according to Morse G. Dial, president. Stockholders approved this change at the annual meeting of the corporation on April 16. The names of three divisions of Union Carbide have also been changed. Carbide and Carbon Chemicals Co., has become Union Carbide Chemicals Co. Linde Air Products Co. is changing its name to Linde Co., and Carbide and Carbon Realty Co. will be known as Union Carbide Realty Co.

## Aerial Drop Platform Designed

► Brooks & Perkins, Inc., Detroit, Mich., under contract with the Wright Air Development Center of Dayton, Ohio, has produced an aerial drop platform, designed to parachute heavy equipment to paratroopers. The air delivery platform is made of lightweight magnesium and equipped with a series of barrel-shaped rubber bags, produced by the Aviation Products Division of the Goodyear Tire & Rubber Co.,

extending along its underside. Carried on a roller-type conveyor in an airplane's cargo compartment, the loaded raft is ejected from the plane and lowered to the ground by parachute. During descent, plywood doors, restraining collapsed air bags, spring open to permit the bags to inflate. Uprushing air cushions the fall of the platform, and diaphragms control the escape of air to prevent blowouts and sudden load shocks. A variable-diameter orifice provides controlled deceleration. The bags are 34 inches in diameter and are made of nylon fabric thinly covered with rubber. Platforms are manufactured in 11, 15 and 24 foot sizes. The smallest unit, using four air bags, accommodates 5,000 pound loads. The largest platform, with 20,000 pound capacity, uses 12 cylinders. The units are recoverable. The photograph above shows a platform and cargo descending.

## New Epoxy Plasticizers

► Introduction of two epoxy plasticizers has been announced by the Celanese Corporation of America, New York, N. Y. The new plasticizers, named "Celluflex 21" and "Celluflex 23", are reported to impart outstanding low-temperature performance and color stability to polyvinyl chlorides and other polymers with reduced plasticizer loss due to volatility. They also provide low viscosity and good viscosity stability for plastisols. End product applications in which the new plasticizers contribute include vinyl film, sheeting and coated fabrics, extruded tubing and hose, slush molded and injection molded items. The materials also serve in synthetic rubber formulations. The epoxy plasticizers are the newest of an increasing group of products being produced in the new multi-million dollar Celanese chemical plant in Point Pleasant, West Va.

## Boosting Polyethylene Capacity

► Spencer Chemical Co. announced plans to double the capacity of its polyethylene facilities at Orange, Texas. The expansion will increase production at the plant from 45 million pounds a year to 90 million pounds. The new facilities will produce conventional and medium density polyethylene by the high pressure process employed since the plant started in 1955. No additional financing will be necessary, the company said. This program is currently under way and will be completed within one year.

Mr. Spencer said forecasts indicate that consumption of conventional polyethylene will probably increase some 250 million pounds in the next four years, notwithstanding the recent development of other types of polyethylene. The company is also active in low pressure polyethylene as a licensee under Standard Oil Co. (Indiana) patents for a low pressure process to produce high density polyethylene, polypropylene and copolymers of both. At present, Spencer has pilot plant facilities in operation at Pittsburg, Kan., under the Standard license agreement.

## Introduces ASRC 3110

► American Synthetic Rubber Corp., New York, N. Y., is now offering in commercial quantities "ASRC 3110", a non-discoloring, non-staining butadiene-styrene polymer with an extremely low Mooney viscosity. A cold rubber version of the old GR-S 1010, ASRC 3110 is said to be the first radically improved butadiene-styrene rubber since the government copolymer facilities were sold to private interests. American Synthetic states that 3110 has lower average raw polymer Mooney and superior physical properties. Designed particularly for use in the manufacture of blown sponge, it is already being sold in carload quantities for this purpose. ASRC 3110 is said to have the following advantages over GR-S 1010: easier mixing, smoother extrusion, faster extrusion, smoother calendering, less shrinkage, higher tensile and modulus, better aging, and better hot tear resistance. Company officials believe that this new polymer will find wide use in a variety of rubber products.

## Drops Urethane Royalties

► Firms licensed under E. I. du Pont de Nemours & Co. isocyanate patents to make urethane foams and coatings will no longer be required to pay royalties under a new policy announced today by the company's Elastomer Chemicals Department. Upwards of 100 licensees have been notified that effective April 1, the one and one-half per cent royalty on the selling price of urethane products manufactured under Du Pont patents has been eliminated. William H. Ayscue, DuPont's isocyanate sales manager, said "that the new royalty-free policy is designed to further stimulate and encourage the fast growing industry by removing the requirements of record keeping, reporting, and royalty fees."

# Canadian News

*At the Annual Meeting of the Rubber Association of Canada held recently in Toronto, Ont., W. H. Funston, president, and Gregg B. Smith made some interesting comments on the future of the Canadian rubber industry. The rubber industry in Canada is looking forward to another record year and the consenus is that the consumption of new rubber will go up at least 5 per cent. Highlights of the addresses made by Messrs. Funston and Gregg appear below:*

**W. H. Funston**

"Our bright future will not be achieved without a great deal of hard work. There is much talk today of the desirability of shorter working weeks and more leisure time. I have nothing against leisure if it is earned. But I would remind members of the Association that the increase in Gross National Product predicted in the Gordon Report is predicated upon a steady increase in productivity at a rate of between 2.5 per cent and 3.25 per cent per annum. It will be necessary, therefore, for industry generally to be on its guard against yielding to demands for a shorter working week that are not justified by increases in productivity.

"Our brilliant prospects will not be realized if Canada's international trade policies continue to sacrifice the interests of Canadian secondary industries to further the interests of primary industries.

"The Gordon Report's forecasts of employment and national output assume an increase in employment in secondary manufacturing industries from 1,049,000 workers in 1955 to 1,907,000 workers in 1980, and assume that these industries will rise in their relative importance in the economy to account for 25.3% of the total national output.

"Yet every year the rubber industry and many other major secondary industries which sell most of their output on the domestic market see themselves losing ground to a growing volume of imported goods which push their way into the Canadian market over tariffs that have been lowered and anti-dumping regulations that have been weakened in a questionably successful effort to broaden foreign markets for Canadian primary products.

"It is encouraging to note that the Gordon Report recognizes the need for a re-examination of Canadian tariff policies and for more effective protection against dumping. It is sincerely to be hoped that Ottawa will take the relevant section of the Report to heart and be guided accordingly.

"The growth foreseen in the Gordon report will not be attained unless enormous sums of capital are available through the years ahead to finance the vast expansion of manufacturing capacity in secondary industries that will be necessary to enable them to provide the increased employment and output that is expected of them.

"This brings us directly to the question of industry profits and income taxes which hold the key to the financing of industrial expansion whether by re-investment of accumulated profits or by attracting new capital into industry. On this point the trend in recent years, as revealed in the annual publication, Taxation Statistics, issued by the Department of National Revenue, is not reassuring. A mass of statistics could be quoted to prove this statement but would be difficult. However, this is a sketch of the position:

"In the four years up to the end of the 1954 fiscal year, the last year for which figures are available, during which period total sales of the entire manufacturing industry rose each year from $15.4 billion in 1951 to $17.8 billion in 1954, profits before taxes decreased each year from $1.5 billion, a ratio of 10.1% on sales in 1951, to $1.1 billion, a ratio of 6.4% on sales in 1954.

"Taxes, however, rose during the same period from 44% of total profits in 1951 to 48% in 1954, with the result that profits after taxes declined from $862 million, a ratio of 5.6% on sales in 1951, to $593 million, a ratio of 3.3% on sales in 1954.

"Profit ratios in the rubber industry have consistently been somewhat lower than the averages for the manufacturing industry as a whole. This profit record must be improved if adequate supplies of capital are to be available for financing the expansion needed in our secondary industry. The remedy lies partly in our hands and partly in the hands of government. It is up to industry to operate efficiently and produce more."

**Gregg B. Smith**

"Canadian consumption of new rubber in the current year will again increase some 5 per cent to around 96,250 long tons, a new record. This will consist of 45,000 tons of natural rubber, including latex and 51,250 tons of synthetic.

"Canadian rubber consumption moved to a new peak in 1956, up more than 8 per cent at 91,457 tons. Feature was the sharply increased use of synthetic rubber. Solid S-type synthetic rose sharply at 38,700 tons, a 20 per cent gain. Use of all other synthetic types were up as well. Actually of all new rubber used in 1956, natural rubber, including latex, accounted for 47 per cent, as compared with 52 per cent the previous year.

"The outlook for 1957 is continuing bright in major rubber using fields. Total domestic tire sales for the first quarter schowed an increase of some 15 per cent over same period of last year. The increase was largely in passenger tire sales, with sales of other types showing little change from last year.

"Sales of mechanical goods continue to show varying trends. First quarter sales show decreases in all types of rubber hose and a slight decrease in flat transmission belting. But sizeable increases are showing in conveyor belting and packing.

"In footwear, the first two months of 1957 show a fairly heavy drop in sales of waterproof rubber footwear compared with the same period last year. On the other hand sales of canvas footwear show a slight increase.

"But there is no reason to look for any material and lasting improvement in sales of Canadian rubber footwear until the government takes action to place competition between footwear made by Canadian labor and that made by low-wage Asiatic and European labor on a more equitable basis.

"The rise in volume of imports of rubber products that has been practically uninterrupted ever since the end of World War II continued throughout 1956 to raise total value of imports to a new peak at $36,892,683 up to 18 per cent from 1955.

"The downward trend in Canadian exports of rubber products that has marked the past several years carried through 1956, although the rate of decline eased off somewhat. Total exports in 1956 were valued at $9,337,355, off 5 per cent. A few items such as rubber soles, camelback and miscellaneous rubber manufactures showed quite substantial increases in value, but these were outweighed by heavy decreases in belting and in all types of tires and tubes.

"Total production of synthetic rubber by the Polymer Corp. in 1956 amounted to 120,701 long tons, a new peak and up 16 per cent from previous year. Total production for 1957 is expected to show a further rise to 130,000 long tons, and a plant for production of foam sponge latex and other specialties will be built during the year.

"In spite of increasing competition from the expanding U. S. synthetic rubber industry, Polymer Corp. looks forward to capacity sales in the present year.

"Total domestic sales of tires in 1956 at 7,679,952 units exceeded 1955 record by 10 per cent. In passenger tires, the increase amounted to slightly less than 10 per cent and occurred almost entirely in the replacement field.

"In truck tires the increase was about 17 per cent and was most pronounced in original equipment sales which increased by 45 per cent."

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The directors of Gutta Percha & Rubber, Ltd. have announced the election of M. O. Simpson, Jr., as president of the company. Mr. Simpson is director and vice-president of Combined Enterprises, Ltd., and Hamilton Gear and Machine Co., Ltd. He will continue as chairman of the board of Gutta Percha & Rubber, Ltd.

▲ ▲ ▲

Monsanto Canada, Ltd., affiliate of Monsanto Chemical Co., will start producing accelerators and antioxidants used in making synthetic rubber. Production will get under way this fall at the Monsanto Ville LaSalle plant at Montreal.

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# Obituaries

### *Stephen G. Luther*

► Stephen G. Luther, a director and former vice-president of the Midwest Rubber Reclaiming Co., Barberton, Ohio, died on May 16 after an extended illness. He was 80 years old. Born in Tiverton, R. I., Mr. Luther was a graduate of Wooster Polytechnic Institute with a degree in mechanical engineering. He began his carreer in the rubber reclaiming industry in 1910, when he joined the U. S. Rubber Reclaiming Co. Among Mr. Luther's early responsibilities was an assignment to go to Russia to locate and construct a reclaiming plant. Later, he became associated with the Philadelphia Rubber Works Co. as factory manager of the reclaiming plant in Philadelphia. He transferred to Akron in 1919, taking charge of the Development Department of the Philadelphia firm. He joined Midwest Rubber Reclaiming, then known as Akron Rubber Reclaiming Co., at Barberton in 1927. In 1928, he was assigned to the design and construction of Midwest's plant at East St. Louis when the organization expanded. The new plant was put into operation in 1929 and Mr. Luther served as factory manager there for many years. During this time, the Barberton property was consolidated under the Midwest name and each plant was expanded and modernized on several occasions under Mr. Luther's direction. His active career came to a close with retirement from Midwest in October, 1956. Mr. Luther leaves his wife, two sons and a daughter.

### *Charles S. Cole*

► Charles S. Cole, inventor and retired president of the Fabrics Fire Hose Co., died on May 19 at the Danbury Hospital in Connecticut. He was 71 years old. Mr. Cole invented several looms and other machines. He served as general manager of Fabrics Fire Hose until his father, the late William T. Cole, retired in 1941. He then took over as president and held the office until his own retirement in 1953. He was succeeded by his son, William Cole. Mr. Cole was born in Paterson, N. J. and lived in Newtown, Conn. for more than fifty years. He is survived by his wife, his son, two daughters and his mother.

### *Alfred C. Gunsaulus*

► Alfred C. Gunsaulus, manager of the Wheel and Brake Development Division of the Goodyear Aircraft Corp., died on April 15 in Akron General Hospital, Akron, Ohio, after a week's illness. Mr. Gunsaulus would have completed 35 years with Goodyear next July. Mr. Gunsaulus was a member of the Akron City Club, Society of Automotive Engineers and the American Society of Mechanical Engineers. He leaves his widow and son

### *James W. Jenkins*

► James Wilfred Jenkins, territory manager of Firestone Tire and Rubber Co. with headquarters in Newark, N. J. and former Akron rubber broker, died on May 20 in the Hazard Hospital in Long Branch, N. J. He was 38 years old. Mr. Jenkins was born in Preston County, West Va., and was an Akron resident for 22 years. He began his career in the rubber industry with A. Schulman, Inc. after attending the University of Akron. In 1950, he organized his own rubber brokerage firm, J. W. Jenkins and Co., in Akron, after having had experience trading in rubber and plastic materials. He dissolved his rubber brokerage firm in 1953 to accept a position with the New York office of A. Schulman. Mr. Jenkins spent three and a half years with the 36th Infantry Division in World War II, serving in North Africa, Italy, France and Germany. He won the Bronze Star Medal and six battle stars. He is survived by his wife, a son and a daughter.

### *Alva W. Woodward*

► Alva W. Woodward, retired consulting engineer of the Goodyear Tire & Rubber Co., died on March 30 in Akron, Ohio, following a heart attack. He was 73 years old. Mr. Woodward joined Goodyear in 1927 in the Rim Development Department. During the years, he filed more than a score of patents, all of which led to improvements in automotive wheels and rims. Mr. Woodward, a graduate of Tri-State College and Purdue University, retired from Goodyear in January, 1957. He leaves his widow and two sons.

### *Charles H. Brook*

► Charles H. Brook, comptroller of the Goodyear Tire & Rubber Co. from 1921 until 1952, died of a heart attack on April 11 near Savannah, Ga., while on an automobile trip. Mr. Brook, who was 74 years old, had resigned in 1952 because of ill health. Born in London, England, he was educated in English schools, and passed the examinations of the Institute of Chartered Accountants with honors. He came to the United States in 1912 and joined Price Waterhouse & Co. He joined the Goodyear organization in 1921.

### *John W. McConnell*

► John W. McConnell, secretary and a director of the Polson Rubber Co., Garrettsville, Ohio, died on April 1 at the age of 74. Mr. McConnell had completed thirty years' service with the company, having started in 1927 as a sales representative. He held the position of sales manager for a number of years. Burial services were held on April 4 in Lima, Ohio.

### *Clifford Greeneisen*

► Clifford Greeneisen, production planning manager at the Noblesville, Ind., plant of the Firestone Tire & Rubber Co., died on April 21 in Noblesville. A native of Salem, Ohio, he attended Wittenberg College. Mr. Greeneisen had served in Akron for several years until his transfer to Noblesville six years ago.

### *Maurice McCarthy, Jr.*

► Maurice McCarthy, Jr., vice-president of Anaconda Wire & Cable Co., died on May 24 in Chicago, Ill. after an operation. He was 50 years old. Mr. McCarthy had been with Anaconda since 1930, first in Cincinnati, then in Muskegon, Mich.

### *L. E. Warford*

► L. E. Warford, president and treasurer of Melflex Products Co., Akron, Ohio, died on May 12 at the Good Samaritan Hospital in West Palm Beach, Fla., after a long period of ill health. He was 66 years old.

### *James W. Carroll*

► James William Carroll, a technical and mechanical supervisor for the Anaconda Wire and Cable Co., Hastings-on-Hudson, N. Y., died on April 13 at St. John's Hospital in Yonkers, N. Y. He was 57 years old.

# West Coast News

► The Bristol Co. of Waterbury, Conn., has opened a new branch factory and repair laboratory in Los Angeles, Calif., as part of a general expansion program. The new facility will be managed by J. W. Peckham, who has been West Coast district manager for Bristol for many years. The new branch will enable the company to step up delivery schedules to automatic controlling and recording instrument customers on the West Coast, as well as providing rapid repairs and service for users.

► Appointment of a new West Coast sales agent has been announced by the Alco Oil & Chemical Corp. of Philadelphia. Pacific Polymers, Inc., Hawthorne, Calif., will handle sales of the complete Alco product line, including Vulcanol rubber latex compounds, Vulcacure ultra accelerators, Trenamine wetting agents, Alcogum chemical stabilizers and thickeners, Vulnopol shortstops and Trenisol film forming dispersions of plastics. C. H. Churchill is general manager of Pacific Polymers.

► Quality Products Manufacturing Co., 125 West 157th St., Los Angeles, was swept by fire on April 30 causing an estimated loss of $150,000. Fire officials stated that the 60 by 90 foot structure in which the plant was housed was a total loss. Quality Products manufactured a line of mats and matting.

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## Overseas

*By Comtel-Reuter*

**Monrovia**—Nearly 30,000 Liberian workers employed by the Firestone Plantations Co. in Liberia were to have received a ten per cent salary increase in May. It is said that the increases will cost the company about $750,000 annually added to the $4,000,000 annual salary bill. The lowest rate of increase is five cents per diem and rubber tappers will now make a minimum wage of forty cents per day.

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**Milan**—The synthetic rubber plant now being constructed at Ravenna by the Societa Anic is expected to start operations by the spring of 1958. The company is also planning to build an oil refinery near Rome.

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**New Delhi**—The Communist Chief Minister of Kerala State has declared that he intends to recommend to the Central Government nationalization of all foreign-owned plantations in the state. It will be left to the Central Government, however, to make the final decision in the matter.

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**London**—The Chairman of the Bank of British West Africa has stated that a major rubber industry could be established in Nigeria. He noted that the uncertainty of supplies has turned more buyers to Nigeria. Quality of Nigerian rubber has improved, he said, and there seem to be good prospects for a regular demand for much larger supplies.

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**Kuala Lumpur**—A spokesman for Chinese rubber exporters in Malaya has advised that no procedure for selling rubber to Communist China has yet been evolved. It was noted that while China's requirements last year were very small they had an effect on the market out of all proportion to their size.

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**Tokyo**—A bill authorizing government financial assistance for the establishment of a semi-official company to produce synthetic rubber in Japan has been passed by the National Diet. The Japanese Rubber Manufacturers Association states that the plan will permit the manufacture of 27,000 tons of GR-S type dry rubber and 3,000 tons of latex by 1959.

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**Singapore**—Malayan rubber traders plan to petition the Government to allow Communist China to station a few purchasing experts in the country to buy rubber. The experts would represent the All-China Import and Export Corporation and would have the authority to buy up to five thousand tons of Malayan rubber per month.

—•—

**Lyons**—Fire has burned down part of a rubber and plastics factory near this city, causing damages estimated at 300 million francs. The fire started in a section of the plant where polyethylene pipe was being manufactured and soon spread to neighboring areas where rubber and resin products were in process.

**Singapore**—According to members of a Japanese rubber trade mission, Japan hopes to buy increasing quantities of rubber from Malaya. Japanese consumption is increasing and is expected to rise by some 20,000 tons this year from last year's total of 100,000 tons of natural rubber.

—•—

**London**—Methods of inspection and handling of rubber in the United Kingdom came under study at a recent meeting of the Malayan Rubber Export Registration Board, the Rubber Trade Association of London and United Kingdom rubber manufacturers. The aim of the meeting was to secure effective functioning of the Registration Board in the prevention of sub-standard packing of rubber.

—•—

**Kuala Lumpur**—The Malayan delegation to the International Rubber Study Group Conference to be held at Jogjakarta in Java this June, is expected to oppose a French proposal for the establishment of a rubber buffer stock to stabilize world prices of natural rubber. It was said that the Malayan delegation sees no need for such a plan.

—•—

**London**—The Rubber Traders Association has decided to remove a clause from the Association's London contract whereby any variation in the 15 per cent surcharge should be for the account of the buyer. There is now no surcharge clause in existence, although a surcharge of 5 per cent is still in effect on shipments from the Far East.

—•—

**Havana**—A new Firestone tire plant with a capacity of 100,000 tires a year is nearing completion on a 59-acre plot near this city. Most of the equipment which will be used in the plant has already been delivered and is ready for installation.

—•—

**London**—The Parliamentary Secretary to the British Board of Trade has told the House of Commons that during the past six months two British firms had started commercial production of synthetic rubber. He stated that production of synthetic at the two plants was only a small proportion of the total synthetic rubber imported at the present time.

—•—

**Bombay**—Firestone Tyre & Rubber Co. of India, Ltd., will enter into a partnership with the National Industrial Development Corp. to set up a 20,000 ton a year synthetic rubber plant near Bombay. Firestone has not yet decided whether it will make a direct investment in this state-owned project or extend long-term credits for machinery.

—•—

**Yokohama**—Goodrich Chemical is reported to have reached an agreement with Nippon Zeon calling for the establishment of a synthetic rubber plant in Japan. Nippon Zeon, a vinyl chloride manufacturer, will be backed by the Yokohama Rubber Co. and other companies belonging to the Furukawa group. Initial production will be 8,500 tons a year.

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Types, grades and blends
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. . . a new high-quality, highly effective rubber reclaiming agent . . . *production-proved* on natural and synthetics, including those hard to reclaim. Typical physical properties of PITT-CONSOL RECLAIMER "500" are listed as follows:

**properties**

| | |
|---|---|
| Physical State | Liquid |
| Specific Gravity | 1.072—1.085 (25/25) |
| Viscosity | 15 cp. (78°F)<br>50 cp. (32°F) |
| Color | Dark Brown |
| Flash Point | 335°F (Open Cup) |
| Initial Boiling Point | 410°F |

PITT-CONSOL RECLAIMER "500" is produced from a large supply of captive raw materials. Technical assistance, data sheets and samples are available.

Inquire also about Pitt-Consol's new line of rubber peptizers and anti-oxidants—now available for laboratory and on-the-job evaluation.

• By a leading producer of high purity cresylic acids.

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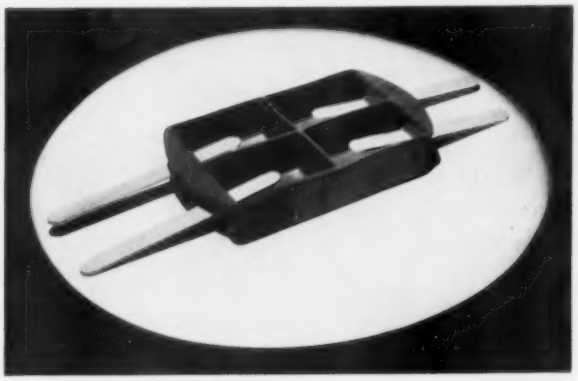
# New Goods

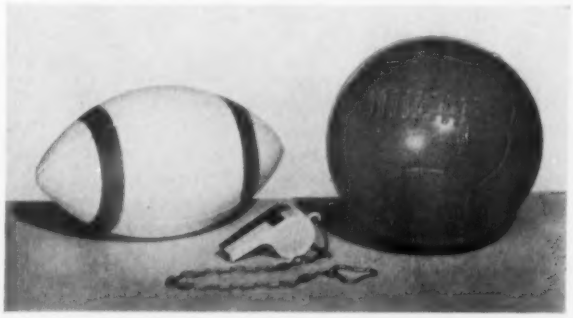
## E Z Y Frozen Sucker Molds

▶ Paeco Products Inc., Ravenna, Ohio, has developed "E Z Y Frozen Sucker Molds" made of natural rubber and reinforced with Pliolite S-6B. For home use, wooden handles are inserted into four compartments of the mold which is then filled and refrigerated. The frozen suckers are released by flexing the mold. Incorporated into the natural rubber by mill mixing, the plasticising properties of Pliolite S-6B promote rapid dispersion of the other compounding ingredients. In actual use, the frozen sucker mold is subjected to temperature variations ranging from sub-freezing to more than 100°F. The material was found to provide the necessary flexibility throughout the entire temperature range.



## Pee Wee Sports Kit

▶ The "Pee Wee Sports Kit", manufactured by the Sun Rubber Co., 366 Fairview Place, Barberton, Ohio, includes a football, playball and whistle for the referee and is packaged in a polyethylene bag with a handle. The football is six inches long, three inches in diameter and is an exact replica of Sun Rubber's official size football. Available in assorted colors with two white stripes, the football is all-vinyl, air-filled and permanently sealed so that it won't leak. The playball is a 4½ inch all-vinyl sports ball with a soccer ball design. It is available in red, yellow and blue.



### Kestral Inflated Water Toys

► Kestral Corp., 25 Willow St., Springfield 1, Mass., has introduced a sports car with built-in horn noise-maker, a novelty sea-going dog and other new inflatable toys made of durable Krene vinyl film to provide youngsters with extra fun in the water this summer. Krene

vinyl film is said to be tough, resist tearing, salt and fresh water, sand, harsh sunlight and sun-tan lotions. The soft flexible material is printed with attractive designs for these water toys. The sports car, shown above, has simulated wheels and a split tail so that it is self adjusting for children.

### Goodrich Mucker Belt

► B. F. Goodrich Co., Akron, Ohio, has announced the development of a new type mucker belt said to have a special interior fabric reinforcement designed to distribute shock loads from impact, improve cover adhesion and reduce stretch. Receiving the load is often the severest trial of belts and a new construction provides its own cushion against load impact. In actual use, the belt has been found to have satisfactory tonnage, eliminate lengthwise belt splits and excessive stretch and demonstrate excellent adhesion of rubber covers to belt carcass, the company says. Handling over 20,000 cubic yards of the material, the belts required only occasional adjustment of take-up. They have handled single rocks weighing as much as 3,000 pounds each.

### Sun Rubber Sunny Tears Doll

► "Sunny Tears" is the name of a new doll manufactured by the Sun Rubber Co., Barberton, Ohio. The new doll is said to have a 100 per cent mechanically perfect Sun-patented device which brings tears to its eyes without the use of a pacifier of any kind and without being squeezed. According to the company, this feature makes the Sunny Tears doll completely different from any tear doll the trade has ever seen. This new Sunny Tears feature will be incorporated in 13 and 18 inch size dolls and accessory groups, with molded and rooted hair, in brown-skinned models and in Sun Rubber's Baby Bannister dolls.

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| *MGO (Ignited Basis)* | *97.9%* |
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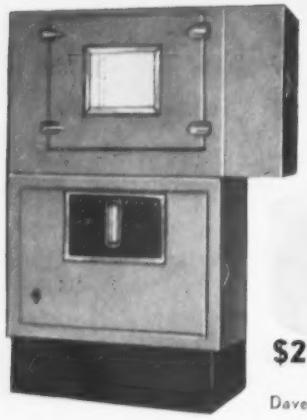

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SPECIFICATIONS

Ozone Concentration Range: 15 to 1,000 pphm
Temperature Range: 5° below ambient to 200° F ±1° F.
Air velocity over sample: 2 feet/second
Chamber dimensions: 20" x 20" x 25" (5.7 cubic feet)
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Thiokol Chemical Corp.
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## Industrial Rubber Bucket

► Cauchotex Industries, Inc., San Juan, Puerto Rico, has started the manufacture of rubber-and-fabric buckets made out of worn automobile tires. The buckets will be marketed in the United States. Named "Fortex", they are produced by a patented process in 10 and 12 gallon sizes and are said to be virtually indestructible. The buckets have been shown to resist all after effects of cement, plaster, paint, acid, dyes and chemicals. They

do not dent, rust or corrode, become brittle or twist out of shape, the company says. There are no sharp edges and the buckets are both light and pliable. In the patented process utilized for the manufacture of these buckets, tires are cut into sections and pulverized with heat and pressure. Natural and reclaimed rubber, cord and chemicals are added and the mixture is pressed into sheets. The sheets are finally put into presses which vulcanize and mold the material into the finished bucket. Based on industrial acceptance, Cauchotex has decided to add a full line of smaller buckets for home use.

## Light-Weight Bowling Ball

► Manhattan Rubber Division of Raybestos-Manhattan Inc., Passaic, N. J., has introduced a new light-weight bowling ball for teenagers and women. The nine-pound full size ball has exceptionally high strength for its weight, officials state. According to the company, the ball is made to the same precision standards and is drilled as accurately as the heavier regulation Manhattan balls.

## Heavy Duty Bucket

► Wooster Rubber Co., Wooster, Ohio, has added a new product to its line of Rubbermaid housewares. The new item, a "Heavy Duty Bucket", has a bail handle; recessed fingertip lugs on the bottom; two pouring spouts on opposite sides of the bucket rim and graduated capacity markings. The bucket is available in red, yellow and grey.

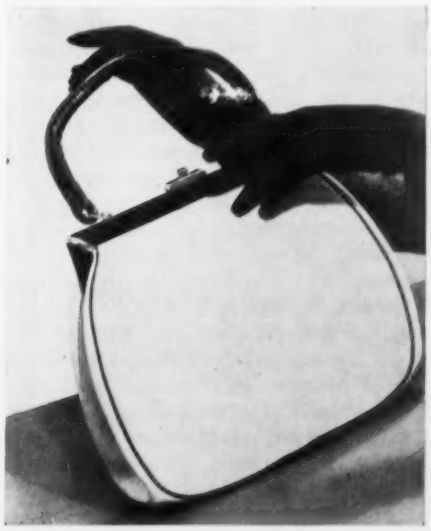
## Polyethylene Toy Figures

► J. H. Miller Manufacturing Co., Quincy, Ill., has introduced a new line of polyethylene toys, which utilize Pliolite S-5 to provide basic colors and second finishes for surface markings on the figures. The colorant is formulated for addition to the melted plastic prior to molding. The second finish, for surface markings, is

prepared for application by brush or spray. Representing lions, tigers, giraffes and many other jungle animals, the toys require careful surface coloring for authenticity. Metal masks are employed wherever possible to expedite production.

## Symphony Fabric Handbags

► Handbags manufactured by Ingber & Co., New York, N. Y., feature a new textured fabric called "Symphony" consisting of rayon and "Velon" yarn. Velon



yarn is said to add luster, strength and soil resistance to the fabric. Bags made from this material have been designed in a variety of styles in black, white, navy and beige.


# Masterbatched BUTYL COLORS

Included in the line of Disco dispersed colors are the increasingly popular Butyl masterbatch colors. These colors are dispersed in a non-staining Butyl polymer (rather than in a compatible vehicle) thus assuring maximum development of color whether Butyl stocks are mixed hot or cold.

**Efficient**—23 basic color masterbatches reduces blending difficulties

**Economical**—Maximum development of color

**Easy to Handle**—No dust or cleaning up problem

**Inquiries invited.**

**Samples on request.**

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*Best scorch protection yet . . .*

**MAGLITE® D**

The performance-proved magnesium oxide

Recent tests in the Merck Rubber Research Laboratories conclusively prove that MAGLITE D provides better scorch protection in neoprene compounds than other reactive magnesium oxides on the market. Additionally, it occupies only about one-third the warehouse space as many of the lightweight, reactive magnesium oxides. You can always count on uniformity of chemical and physical characteristics, ease of dispersion, practical cure rates, and speedy delivery when you specify the MAGLITE brand. MAGLITE D is ideal for compounding neoprene and Hypalon. MAGLITE K, L, or M is particularly well-suited for other elastomers and for certain product or process requirements. Stocks of all MAGLITE products are quickly available from 15 strategically located warehouses.

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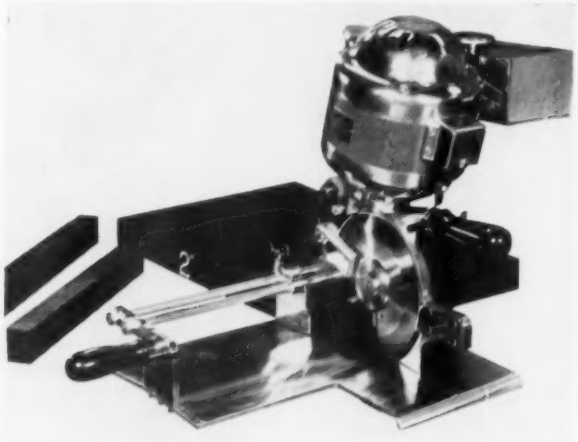
# New Equipment

## Eastman Portable Rubber Strip-Cutter

► A new portable rubber strip-cutter, designed to cut strips from ⅛ to 10 inches wide, from slabs up to 2 inches thick and of densities up to 80 Durometer hardness, has been introduced by Eastman Machine Co., 779 Washington St., Buffalo 3, N. Y., as Model RS-75. Claimed to be the most powerful machine of its



kind, the new strip-cutter was engineered in a rubber manufacturing plant to provide fast, easy and accurate cutting.

Among the important features are a calibrated guide that assures square cut strip kept within a tolerance of .010 (the guide may be removed to cut larger sections of the slab as needed); a moistening attachment for the blade edge and the gauge to allow the strip to move easily through the machine; an automatic knife sharpener that renews the edge while the machine is cutting, and a compact, one-horse power motor that enable the machine to slice through cured and non-cured rubber easily.

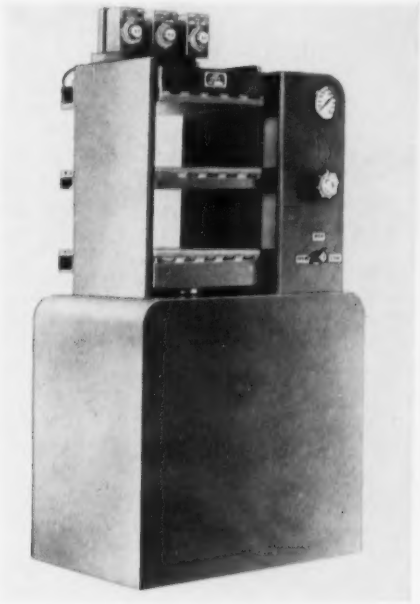
## Tri-Homo Tri-Blender

► Thorough mixing, blending and particle size reduction plus heating or cooling of the product is the function of the Tri-Homo Tri-Blender offered by the Tri-Homo Corp., 94-100 Highland Ave., Salem, Mass. A jacketed housing made of heavy wall tubing regulates the heat inside the machine. Two stainless steel spring tension scraper or wiping blades remove the product from the heated or cooled surfaces. The actual contact of the blades scrapes the wall clean with each half turn in one direction, or smears the product with the spring tension when operated in the opposite direction. The mixing takes place as the product is forced through an adjustable angular space before discharge at the rear

angular section of the rotor. A valve on the discharge side controls the rate of flow, which in turn determines the temperature change of the product. Capacity of the unit depends on the rate of discharge flow and the number of scrapes or wipes per minute and temperature factors.

### Atlas Hydraulic Press

► A new hydraulic press designed for the precision molding of rubber and plastics has been introduced by Atlas Hydraulics, Inc., 3576 Ruth Street, Philadelphia 34, Penna. Its ability to apply heat and pressure under precise control enables it to do an unlimited number of



jobs for both laboratory and production, claims Atlas.

The new models are produced with 14 x 14 inch electrically heated thermostatically controlled platens. They are completely self contained with the hydraulic pressure aggregating 75 tons capacity. A new hydraulic pump allows constant pressure on the platen area for any length of time without personal attention. They are said to be economical and simple to operate.

Built with slab sides, Atlas Presses have no strain bolts, no nuts to adjust and are permanently aligned. Rams are perfectly machined and chrome plated. Many modifications are available to suit individual customer requirements.

► A **traverse drive** for winding machinery, manufactured by Graham Transmissions, Inc., Menomonee Falls, Wisc., maintains a pre-set speed ratio between output and input shaft despite fluctuations of input speed, including jogging, fast acceleration and deceleration.

Actual part processed by Monarch Rubber Co. with Sealtex. Shows rubber breaks . . . bond holds solid!

AT LOWER COST
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PHOSPHATE COATINGS

Achieve superior bonding with Sealtex phosphate coatings plus TEXO'S proven methods. Users consistently report "stock separation before bond failure" with this low-cost method. Applied by spray or immersion with conventional equipment. Sealtex characteristics are:

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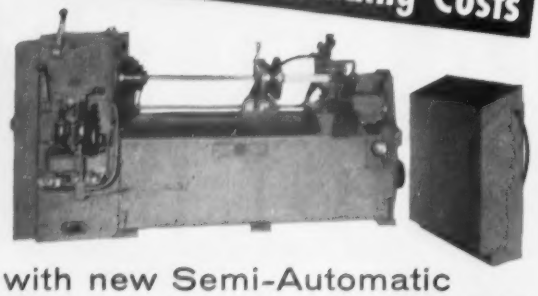

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Makes cuts from full rolls of vinyl, plastic, cloth, cellophane and similar tapes. Easily handles materials to maximums of 37" web, 2½" wall thickness and paper core I.D. 3½".

Same capacity machine also supplied with manual controls.

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- NEW, improved LACQUERS for Rubber Footwear, or any rubber product where lacquer is used as a pre-cure coating.
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- CASUALS, footwear. NCP 1909 is an excellent dulling and anti-tack agent on edges of soles or crepe wrappers used in the manufacturing of casual type footwear.
- SPECIAL lacquers for all types of rubber products.

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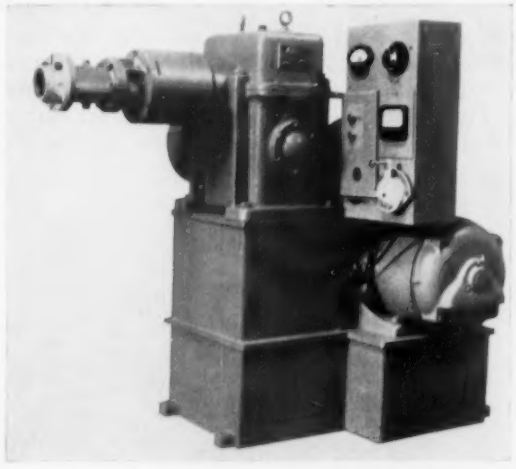
## Rolis Rubber Extruders

► A durable, long-life rubber extruder, featuring a one-piece, heavy-walled, jacketed steel cylinder with removable Xaloy liner, has been introduced by Rolis, Inc., 1240 E. 14th St., Brooklyn 30, N. Y. The extruder, reduction unit and motor are mounted on a heavy steel, one-piece base for added stability. The Rolis machine has oversize thrust bearings and a precision ground screw. Other features include jacketed hopper with under-cut for ease of strip feeding, a heavy-duty gear reduction unit, speed indicator, electrically-heated die holder with heat indicator and controller, and simplified gravity feed lubrication. The extruder is available in all sizes from 1-inch to 4¼ inches, including the 2-inch type shown in the accompanying illustration.



## Pressure Roller Feed

► A new pressure roller feed for rubber extruders said to be excellent for butyl and silicone rubbers and other low-tensile stocks, has been developed by Davis-Standard, Division of Franklin Research Corp., Mystic, Conn. The feeder consists of a highly polished roller driven by a torque-limiting clutch and of a filler block added to the extruder feed throat. As the screw becomes fully fed, the filler block forces the stock against the roller. When the resistance pressure thus created reaches a preset amount, the torque-limiting clutch begins to slip and allows the roller to slow or stop until the feed section is in a position to accept more stock, Davis-Standard engineers point out.

The constant forced feed greatly improves uniformity of extruder delivery, with control within 1 per cent on stocks that formerly were difficult to feed. Ball regurgitation which often causes starvation of the screw is prevented. A scraping knife prevents build-up of stock film on the roller, thereby reducing supervision of the extruder.

# BLOOM REDUCTION

A-SLIGHT BLOOM
(GR-S Cable Jacket Compound)

B-**NO BLOOM**

C-HEAVY BLOOM
(Nitrile Rubber—Sulfurless Cure)

D-SLIGHT BLOOM

E-**NO BLOOM**

## with blends of 'SHARPLES' brand Ultra Accelerators

**These photographs of rubber samples illustrate surface bloom one year after curing . . .**

. . . the tests indicate that, in these two cases, blends of Ethyl and Methyl ultra accelerators will produce less bloom than either one used alone.

Illustrations A and B show the effect of using a blend of Ethyl and Methyl Ziram instead of straight Methyl Ziram in a GR-S Cable Jacket Compound. Photo B shows that bloom has been greatly reduced. The accelerator ratios used were as follows:

| | A | B |
|---|---|---|
| Sulfur | 2.0 | 2.0 |
| MBTS | 2.0 | 2.0 |
| SA-57 (Methyl Ziram) | 1.5 | 0.7 |
| SA-67 (Ethyl Ziram) | — | 0.8 |

Illustrations C and D show the bloom resulting when either Methyl Thiram or Ethyl Thiram is used alone in a Nitrile Rubber-Sulfurless Cure compound. Photo E shows that bloom has been greatly reduced by using equal parts of Methyl and Ethyl Thiram. The ratios used were as follows:

| | C | D | E |
|---|---|---|---|
| SA-52 (Methyl Thiram) | 3.0 | — | 1.5 |
| SA-62 (Ethyl Thiram) | — | 3.0 | 1.5 |

Blends of 'Sharples' brand Ultra Accelerators may be helpful in reducing bloom in your formulations. Technical Report S-122 and samples sent on request.

Pennsalt Chemicals

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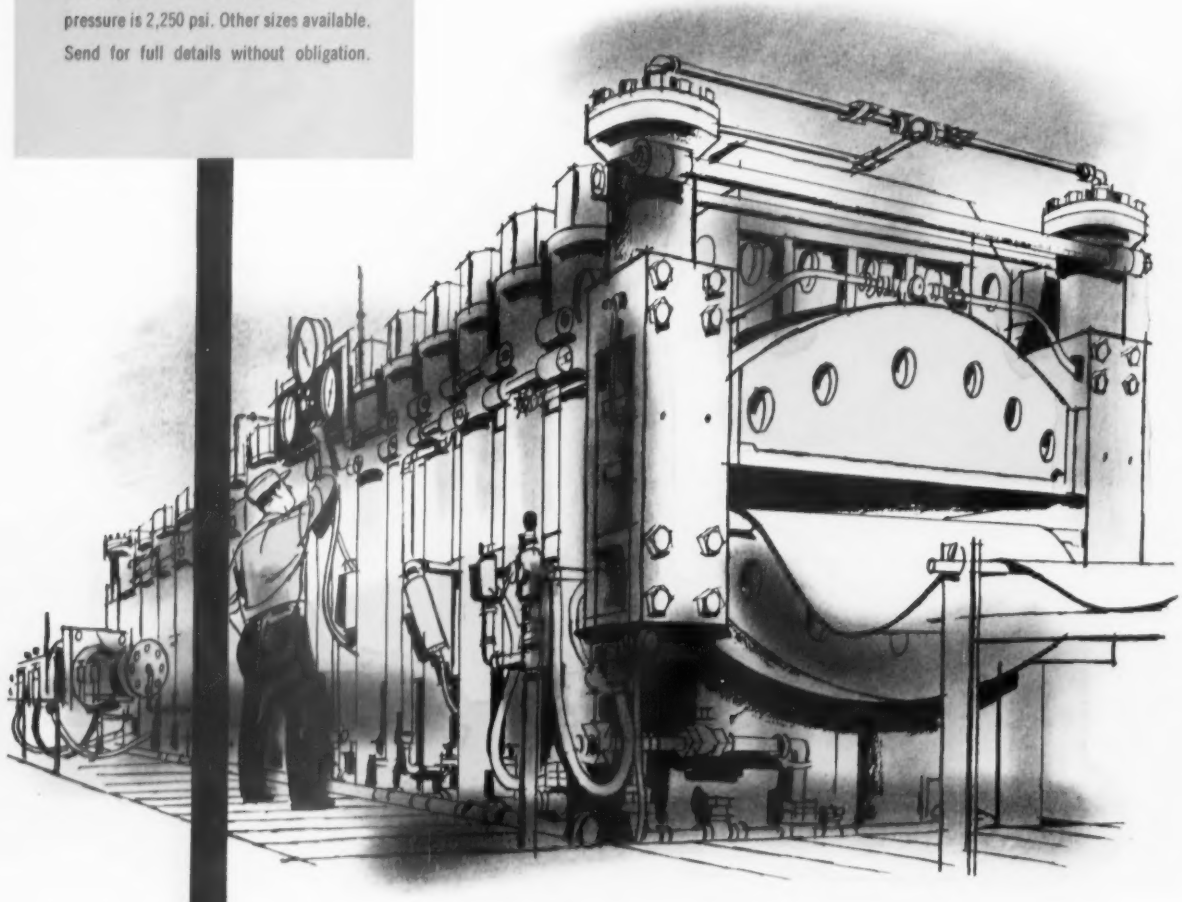
Single Opening Belt Press for vulcanizing rubber belting. Press is equipped with hydraulic stretcher and clamping units mounted at the ends of the moving platen. Press capacity is 3,180 tons. Size of heating platens is 63¼" x 30'0". Maximum working pressure is 2,250 psi. Other sizes available. Send for full details without obligation.

The proof of any press is its performance; excellence invariably shows up in service. How to be sure of quality when you choose a press? Simply look for the name 'R. D. Wood' on the nameplate. In every R. D. Wood Press, sound design, select materials, skilled craftsmanship combine to give you over-all efficiency, operating ease, production economy and long service. Write for engineering data on R. D. Wood Presses for the rubber industry.



**R. D. WOOD COMPANY**

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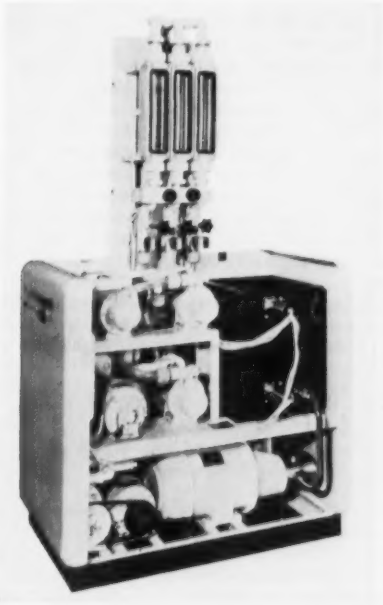
## Ultrasonic Emulsifier Machine

► A new line of ultrasonic emulsifiers manufactured by the Sonic Engineering Corp., 146 Selleck St., Stamford, Conn., features a new principle of operation which has resulted in less expensive and easier-to-maintain machines, and also offers faster and more complete emulsification, says the manufacturer. The machines—called



the Rapisonic, the Autosonic, the Dispersonic and the Minisonic—use the fluid-dynamic forces of the liquids themselves to produce the sound waves, instead of generating the ultrasonic energy outside the liquids. This is accomplished by impinging the liquids to be emulsified in a jet stream on the edge of a blade. The blade vibrates at its natural frequency (about 22,000 cps). Cavitation occurs continuously in the stream rushing past the blade. All energy is developed and used right in the liquids.

The Autosonic, illustrated above, meets the need for a continuous supply of emulsion automatically geared to process volume. The oil, water and emulsificant are pumped separately into the Autosonic via three control valves and flow rate indicators in order to adjust the proportions of each in the final emulsion. Float switches maintain a balance in a reservoir by starting and stopping the feed and discharge pumps as well as the emulsifying unit.

Suggested uses of the equipment in the rubber industry include: production of dispersions which give the same result as clay dispersions but are cheaper, and production of release emulsions, synthetic rubber emulsions and anti-oxidant emulsions.

The Minisonic produces emulsions in quantities of up to one gallon, and is intended for laboratory and pilot plant use. The Autosonic is designed for automatic continuous production.


**The Best Method Yet Devised . . .**

**FOR DICING SHEET STOCK**

**The Famous CUMBERLAND "Stair-Step" Dicer**

Here at last is the answer to your problems of dicing rubber or vinyl sheet stock. Produces perfect cubes ranging in size from ⅛ to ½" by merely changing knives.

Comes in two sizes designed to handle sheets up to 7" or 14" in width. Other sizes made to order.

Input speeds range from 10 to 125 feet per min. depending on material and size of cube desired.

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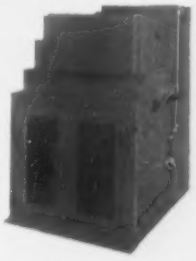

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This is the first book ever published which thoroughly covers the entire rubber industry, including synthetic elastomers, latices of both natural and synthetic rubbers, and even the pertinent plastics, in less than 500 pages.

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# Reviews

## BOOKS

**Rubber Chemicals.** By J. Van Alphen in cooperation with W.J.K. Schönlau and M. Van Den Tempel. Published by the Elsevier Publishing Co. Sole Distributor for the U.S. and Canada, D. Van Nostrand Co., 257 Fourth Ave., New York 3, N.Y. 6 x 9 in. 164 pp. $5.00.

This book has been compiled to meet, in an understandable manner, the long felt need for a simple guide to the rapidly growing field of compounding ingredients utilized by the world-wide rubber industry. The purpose of this book is to give the chemical name of any material together with its trade names in various countries as well as the names of the suppliers. A brief description of each material and its properties is included. Of necessity, the authors have limited their coverage to accelerators, activators, antioxidants, blowing agents, peptizing agents, retarders and vulcanizing agents. Emulsifying agents have been included but these are classified only as to type since in the main they are not pure chemical compounds. Carbon blacks have been referred to very briefly only to explain the abbreviations used in the United States for their classification. Fillers, softeners, stiffeners, pigments, factice and odorants have been excluded for reasons of space. The authors explain that so many of these materials are commercially available that to include them all would have made too bulky a work. Originally prepared for internal use in the laboratories of Rubber-Stichting, this book, now completely revised, makes a singular contribution to the rubber literature in that it provides the rubber technician with a valuable source for much information.

•

**Fibres, Plastics and Rubbers.** By W. J. Roff. Published by Academic Press, Inc., 111 Fifth Ave., New York 3, N.Y. 6 x 9 in. 400 pp. $10.00

This handbook contains extensive chemical, physical and general information on common high polymers, i.e., on materials composed of relative simple recurring units which, in aggregation, give rise to unique properties and find important technical applications in rubbers, plastics, fibers and films. The compilation is designed for ready reference and is intended primarily for those engaged in industrial research and development. While fulfilling this purpose for common polymers, the book will also serve as a practical introduction to the constitution, properties, identification and utilization of these materials. Of particular interest are those sections dealing with such elastomers as butadiene-styrene, butadiene-acrylonitrile, butyl rubber, polyacrylonitrile, polysulfide rubbers, polyvinyl chloride, etc. It is believed that this interesting book will be a valuable addition to the technical library of anyone engaged in the rubber industry.

•

**Technical Data on Plastics.** Published by the Manufacturing Chemists' Association, Inc., 1625 Eye St. N.W., Washington 6, D.C. 8½ x 11¼ in. 214 pp. $3.25.

The purpose of this book is to acquaint the user with the properties which characterize the various commercially available plastics. Each section of the book is devoted to the discussion and presentation of data for plastics sharing either a basic composition, such as vinyl chloride polymer and copolymer, or a basic form, such as thin films. The data presented in the tables were derived from tests made by each manufacturer on his own products. A range of values was then selected which would properly cover all values submitted for a particular grade of material. The methods of test used for obtaining the data were those established by A.S.T.M. A useful bibliography and index are appended.

## BOOKLETS, CATALOGS, etc.

**Neoprene Type WHV.** (Report No. 57-1). By J. F. Hagman and M. A. Schoenbeck. Elastomer Chemicals Dept., E. I. du Pont de Nemours & Co., Wilmington, Delaware. 6¼ x 9½ in. 20 pp.

The special advantages offered to compounders by the use of Neoprene Type WHV are propounded in this technical report. It is divided into two parts, the first dealing with properties and compounding and the second with practical, economical applications. Part I contains a description of the polymer and data on the basic curing system, filler loading and selection of oil. It also includes a comment on the neoprene-carbon black-oil relation. The section on applications includes a number of suggested formulas, with physicals shown in each instance. Among the formulas are those for radiator hose tubes, industrial air hose tubes, automotive windshield sealing strips, washing machine drain hose, and compounds for miscellaneous extruded goods. Neoprene Type WHV is chemically similar to Type W, but has a much higher viscosity.

•

**Essentials of Machinery Procurement and Development.** (Special Report No. 14). American Management Association, 1515 Broadway, New York 36, N.Y. 6 x 9 in. 72 pp.

The basic aspects of machinery acquisition by industrial organizations and the factors that contribute to successful planning of a machinery acquisition program are covered in this booklet. These include: considerations of a financial and tax nature; the contractual safeguards that are necessary in procurement; the problems encountered in a diversified plant; the effective use of a limited budget for new equipment, and an over-all view of a procurement program in a large company. The American Management Association has assembled a group of 13 authors who are active in industrial enterprises and who base their conclusions on practical experience. One chapter is devoted to the engineer's role in equipment acquisition. Charts and graphs are used in the presentation of the material.

•

**NA-33—A Delayed Action Accelerator for the W Types of Neoprene.** (Report No. 57-6). Prepared by R. M. Murray. Elastomer Chemicals Department, E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. 6¼ x 9½ in. 16 pp.

Basic information on the properties of NA-33, a newly developed, delayed action accelerator particularly suited for use with the W types of neoprene, is presented in this booklet. Comparisons are made with other organic accelerators, and charts are used to demonstrate differences in properties of the resulting compounds. One table shows the results obtaining by using blends of NA-22 and NA-33, and another those obtained by using various fillers and reinforcing agents. Discussion is also included on the use of NA-33 in neoprene latex compounds. The booklet provides a comprehensive briefing on the properties and capabilities of the accelerator.

•

**Speedomax G Pneumatic Control.** [Folder ND4(9)]. Leeds & Northrup Co., 4907 Stenton Ave., Philadelphia 44, Penna. 8½ x 11 in. 12 pp.

This attractive booklet provides extensive information on the Speedomax G Pneumatic Control for control of process units in industrial installations. A complete description of how the pneumatic system works is given, with a block diagram used to amplify the explanation. A photograph of the works of one controller is fully keyed to a description of the component parts. Other photographs and line drawings illustrate all pertinent details of the equipment. Standard and optional features are also listed and explained.

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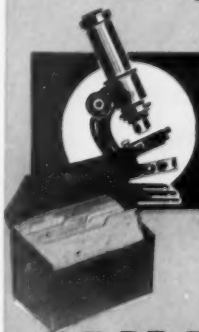
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**Diethylene Glycol and Triethylene Glycol.** Carbide and Carbon Chemicals Co., 30 East 42nd St., New York 17, N. Y. 8½ x 11 in. 16 pp.

Diethylene glycol and triethylene glycol are discussed in this new data folder, which presents information on physical and physiological properties, specifications, shipping containers, constant-boiling mixtures and applications. The folder contains 15 charts showing physical properties of interest to users of the glycols, which are important as intermediates for resins and plasticizers. Many of the applications for these materials are based on their hygroscopic properties and excellent solvent characteristics. Diethylene glycol is used in the production of polyurethane foams, and ester derivatives of triethylene glycol are important plasticizers for polyvinyl butyral resins and other materials. Other ester derivatives are plasticizers for synthetic rubber compounds or for cellulose esters.

•

**Stauffer Sulfurs.** Stauffer Chemical Co., 380 Madison Ave., New York 17, N. Y. 8½ x 11 in. 48 pp.

This attractive booklet is devoted to the history and use of sulfur in general and to the sulfurs sold under the Stauffer label in particular. Basic information on types, uses, production and refining of sulfur is presented. In the discussion of the individual Stauffer sulfurs, detailed technical data are given and recommended applications and characteristics are listed. One section is devoted to rubbermakers' sulfurs. The closing parts are concerned with physical and chemical properties, methods of analysis, the handling of sulfur, and a bibliography. A lavish use of photographs, charts and tables adds to the effectiveness of the presentation. Extensive information on sulfur is provided in this interesting publication.

•

**Young Brothers Industrial Ovens and Dryers.** (Bulletin No. 157). Young Brothers Co., 1831 Columbus Road, Cleveland 13, Ohio. 8½ x 11 in. 16 pp.

Industrial ovens for baking, drying, curing and heat treating are described in this brochure. Sections are devoted to batch type ovens, conveyor type ovens, various air recirculating and heating systems, and control and safety equipment. Illustrations of installations in modern industrial plants are identified by descriptive captions telling the type of oven, the process and product involved. Special attention is given to dielectric ovens which utilize radio frequency power to bake, dry and cure suitable non-metallic, non-conductive materials. The attractive two-color brochure is also illustrated with diagrams of the various ovens.

•

**Polyethylene Processing Tips.** U. S. Industrial Chemicals Co., 99 Park Avenue, New York 16, N. Y. 9¾ x 12 in. 12 pp.

This illustrated and handsomely bound file folder has just been reissued with reprints of Volumes 1 and 2 of the series. Information is included on the selection of polyethylene resins for such applications as molding, extruding, electrical, film, coating and specialty uses. A discussion of the effect of three basic resin characteristics—density, molecular weight distribution and molecular weight—on polyethylene properties is also given with data on the twelve different types of U.S.I. Petrothene polyethylene resins. Other volumes may be inserted into the folder as they are issued.

•

**Solvay Products.** Solvay Process Division, Allied Chemical & Dye Corp., 61 Broadway, New York 6, N. Y. 6 x 9 in. 56 pp.

This new book contains detailed information on the entire line of Solvay alkalies and chemicals. It includes informative data on the uses, markets, physical and chemical properties, packaging and handling and storage of the line. Also included is a listing which groups the products by consuming industries or manufacturing processes. The book is attractively illustrated with photos of buildings and manufacturing operations at the various Solvay plants.

**Symposium on Tension Testing of Non-Metallic Materials.** (Special Technical Publication No. 194). Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Penna. 6 x 9 in. 80 pp. $2.00.

In an attempt to clarify some of the problems existing in the tension testing of non-metallic materials in various fields, ASTM Subcommittee 4 of Committee E-1 held a symposium in June, 1956. The specific objectives were an accurate summary of present practices, a critical appraisal of their merits and deficiencies, a comparison of techniques and terminology, and a guide to future development and standardization. All the papers presented at the symposium are included in this book. They deal with the testing of plastics, adhesives, rubber, wood and paper. The paper on rubber considers such subjects as definitions, preparation of the test specimens, ASTM and other test procedures, tension testing machines, and others. Additional literature of this type should facilitate uniformity of terminology and presentation of tensile data.

•

**Process Control by Tracerlab.** Tracerlab, Inc., 1601 Trapelo Road, Waltham, Mass. 8½ x 11 in. 36 pp.

This bulletin is described by the company as the first comprehensive booklet on radiation gauging. Basic information relative to a wide variety of materials is presented. An extensive description of the various Tracerlab beta gauges is given, with special sections on sensing units, positioning units, registering and control units, and output units. Other sections are devoted to special equipment and services, selection of a gauging system, and typical gauge installations. In the latter part, special applications of the gauges are illustrated by photographs, which depict the control of thickness of rubber prior to application to fabric backing, the control of weight of adhesive coating to cellophane and the continuous measurement of sheet edge thickness of plastic.

•

**A Study of Butyl Solvent and Chemical Resistance.** (Bulletin 102). Thiokol Chemical Corp., 780 North Clinton Ave., Trentorn, N.J. 8½ x 11 in. 16 pp.

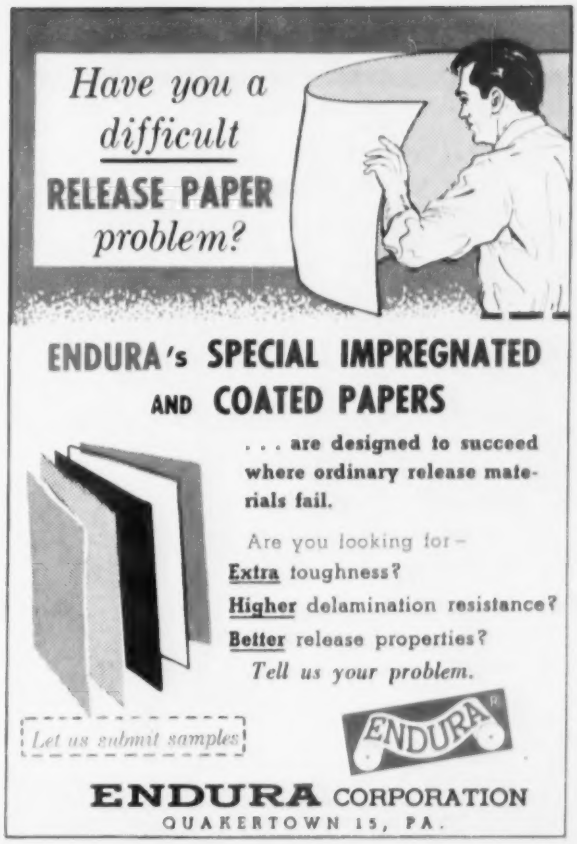
This two-color booklet, which deals with the resistance of butyl rubber to various solvents and chemicals, offers the compounder or the engineer assistance in handling butyl rubber in his shop. Quick reference charts and tables show the reaction of butyl rubber to certain hydrocarbons, corrosive solutions and halogen gases. Also covered is the volume increase of butyl rubber when it is immersed in many of these chemicals. The data include information on other factors influencing resistance, such as fillers, state of cure, cure systems and plasticizers. The booklet should be of aid to anyone who is concerned with the solvent and chemical resistance properties of butyl rubber.

•

**Emersol Stearic Acids.** (Bulletin EM-952). Emery Industries, Inc., Cincinnati 2, Ohio. 8½ x 11 in. 24 pp.

This brochure is designed to aid in the selection of the proper grade of stearic acid for each end use. It interprets the results of analytical tests commonly performed on stearic acids, and contains a discussion of physical properties of commercial stearic acids. Tables which list the composition of typical grades of stearic acid are given, as well as a stearic acid selection chart. Also included is a section covering the handling of stearic acid and a description of all grades of Emersol stearic acids, with emphasis on the significance of oxidation and color stability.

**Additions and corrections are still being accepted for the 1957-58 RUBBER RED BOOK. If you want to amend the data you have already submitted in order to make a complete and correct listing, write us today!**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# MARKET REPORTS

TRENDS
NEWS
PRICES

## Natural Rubber

Since our last report (May 1), the price of spot rubber on the New York Commodity Exchange has moved in a range of 100 points, high for the period being 32.63c reached on May 1, and low being 31.63c reached on May 6. The average price of spot rubber for the month of May was 32.12c based on 22 trading days. This compares with an average of 32.23c in the previous month.

News which will have some bearing on the rubber price structure in the months ahead has come from London, where the British Government has acted to relax restrictions on trade with Red China. Under the government action, more than 200 items will now become available for export to China, including rubber, most tires and chemical products.

### Basis for Current Prices

It is the opinion of many in the trade that there is a sound base under the current price structure for natural rubber. The rate of world rubber consumption is strong enough to sustain prices. Inventories seem to be the center of attention. There are no great pressures to buy or sell rubber anywhere in the world.

There is reason to believe that stocks of natural rubber throughout the world are not large. Consumption of natural rubber throughout the world in 1955 and 1956 was about the same. Indications are that consumption in 1957 may top 1,900,000 tons, although world production will not increase accordingly.

It is known that a fair amount of covering took place at the time of the Suez Canal crisis last fall. This has been responsible for a good part of consumer lethargy so far this year. This extra coverage, however, has been worked off by now. Actually, consumption loss in Europe as a result of the Suez Canal crisis was smaller than initially expected, with the actual loss somewhere near 15,000 long tons rather than the 40-45,000 long tons previously estimated.

Reports coming in from West Europe suggest that surplus inventories have just about been dissipated. In the United States, stocks of natural rubber have likewise been declining, and at the end of March stood at less than 100,000 long tons. Roughly speaking, the monthly average over the past two or three years has been at about the 105,000 long ton level.

It is reasonable to assume from the foregoing that stocks will be built up in the months ahead to maintain a normal ratio of inventories. A glance at shipping arrivals in New York in April and May suggests that stocks in the U. S. will not be permitted to go under the 100,000 ton level.

### Latest Estimates

Latest estimates place total U. S. consumption of new rubber between 1,490,000 and 1,500,000 tons in 1957, with about 38 per cent, or 560,000 long tons, natural rubber. World supply of natural in 1956 will approximate 1,900,000 long tons, just about matching world consumption, a delicate situation at best.

*NEW YORK, JUNE 1, 1957*

## Price Data

### Closing Rubber Prices on New York Commodity Exchange

FROM MAY 1 TO MAY 31

| May | Spot | May | July | Sept. | Nov. | Sales |
|---|---|---|---|---|---|---|
| 1 | 32.63 | 32.50 | 32.06 | 31.85 | 31.50 | 113 |
| 2 | 32.50 | 32.30 | 31.86 | 31.60 | 31.37 | 97 |
| 3 | 32.13 | 31.80 | 31.65 | 31.35 | 31.15 | 61 |
| 4 | .... | .... | .... | .... | .... | .... |
| 5 | .... | .... | .... | .... | .... | .... |
| 6 | 31.63 | 31.35 | 31.15 | 30.95 | 30.70 | 124 |
| 7 | 31.88 | 31.50 | 31.45 | 31.20 | 30.95 | 149 |
| 8 | 31.88 | 31.75 | 31.45 | 31.20 | 31.00 | 24 |
| 9 | 31.75 | 31.55 | 31.35 | 31.10 | 30.85 | 51 |
| 10 | 31.88 | 31.75 | 31.51 | 31.22 | 31.00 | 30 |
| 11 | .... | .... | .... | .... | .... | .... |
| 12 | .... | .... | .... | .... | .... | .... |
| 13 | 32.38 | 32.25 | 31.85 | 31.55 | 31.35 | 121 |
| 14 | 32.50 | 32.25 | 32.05 | 31.80 | 31.55 | 134 |
| 15 | 32.25 | 31.80 | 31.80 | 31.50 | 31.25 | 63 |
| 16 | 32.50 | 32.40 | 32.10 | 31.80 | 31.50 | 80 |
| 17 | 32.50 | 32.20 | 32.05 | 31.80 | 31.45 | 4 |
| 18 | .... | .... | .... | .... | .... | .... |
| 19 | .... | .... | .... | .... | .... | .... |
| 20 | 32.50 | 32.20 | 31.94 | 31.65 | 31.35 | 1 |
| 21 | 32.50 | 32.40 | 32.05 | 31.80 | 31.45 | 54 |
| 22 | 32.25 | 32.10 | 31.85 | 31.65 | 31.35 | 22 |
| 23 | 32.00 | 32.10 | 31.60 | 31.40 | 31.15 | 67 |
| 24 | 31.88 | 31.55 | 31.38 | 31.27 | 31.08 | 81 |
| 25 | .... | .... | .... | .... | .... | .... |
| 26 | .... | .... | .... | .... | .... | .... |
| 27 | 31.75 | 31.70 | 31.38 | 31.05 | 30.90 | 80 |
| 28 | 31.88 | 31.90 | 31.35 | 31.25 | 31.05 | 46 |
| 29 | 31.75 | .. | 31.10 | 30.85 | 30.70 | 30 |
| 30 | .... | .... | .... | .... | .... | .... |
| 31 | 31.75 | .... | 31.20 | 31.00 | 30.80 | 22 |

### Outside Market

| | |
|---|---|
| No. 1 Ribbed Smoked Sheets: | |
| Spot | .31¼ |
| July | .31½ |
| Aug. | .31¾ |
| Thin Latex Crepe: | |
| Spot | .34¾ |
| Thin Brown Crepe, No. 2 | .28¾ |
| Flat Bark Crepe | .21¾ |

### London Market
(Standard Smoked Sheets)

| | |
|---|---|
| July-Sept. | 30.95 - 31.10 |
| Oct.-Dec. | 30.95 - 31.10 |

### Singapore Market
(Standard Smoked Sheets)

| | |
|---|---|
| July | 29.35 - 29.43 |

### Middling Upland Quotations

| | May 1 | May 31 | | |
|---|---|---|---|---|
| | Close | High | Low | Close |
| July | 34.90 | 35.25 | 35.18 | 35.20 |
| Oct. | 33.66 | 34.33 | 34.27 | 34.28 |
| Dec. | 33.69 | 34.31 | 34.22 | 34.24 |

## Notes & Quotes

On his departure for Europe on a visit to the company's plants abroad, Lee R. Jackson, vice-chairman of the Firestone Tire & Rubber Co., observed that the rubber industry is in a period of strong, steady growth. Mr. Jackson expects that by 1960 world consumption of rubber will amount to 3,600,000 tons a year. By 1965, consumption will amount to 4,400,000 tons annually—46 per cent more than in the record year of 1956. Mr. Jackson also pointed out that truck and automobile production in 1957 is expected to rise approximately 8 per cent above 1956 when 6,900,000 cars and trucks were produced. He estimated that by the end of 1957 there will be about 63,700,000 cars and trucks in use in the United States. This figure is expected to reach nearly 72,000,000 by 1960.

## Synthetic Rubber

Total domestic output of all types of synthetic rubber reached 2,314 million pounds in 1956, an increase of 11 per cent over 1955 output of 2,083 millions, the U. S. Tariff Commission has reported. The report, a preliminary one, covers all elastomers but vinyl, which has been transferred to the category of plastics and resin materials. The report is the first in a series of 14 giving preliminary statistics on the production and sales of various synthetic organic chemicals in 1956.

Sales of the elastomers covered in this first report totaled 2,156 million pounds valued at $588 million. The comparable 1955 figures were 2,069 million pounds valued at $573 million. The production of cyclic elastomers, consisting almost entirely of the GR-S type, amounted to 1,808 million pounds in 1956 compared with 1,643 million pounds in 1955. Sales amounted to 1,680 million pounds valued at $403 million in 1956, compared with 1,644 million pounds valued at $402 million in the previous year.

### Acyclic Elastomer Output

Production of acyclic elastomers, consisting of neoprene, butyl, silicone, isobutylene, and other types, amount to 506 million pounds in 1956 compared with 440 million pounds in the preceding year. Sales in 1956 amounted to 476 million pounds valued at $185 million, contrasted with 425 million pounds valued at $170 million in 1955. Of the acyclic elastomers, neoprene was produced in the largest volume (223 million pounds), followed by butyl rubber (166 million pounds).

Preliminary statistics on the production and sales of elastomers given in the report are virtually complete. Complete statistics will be given in the Commission's final report on the production and sales of synthetic organic chemicals, a report that will be issued later this year. Copies of the reports may be secured from the U. S. Tariff Commission, Washington 25, D. C.

### Cold Rubber Popularity

BDSA analysts, writing in the April, 1957, issue of "Chemical and Rubber Industry Report," note that the most striking fact revealed by analysis of production statistics for S-type rubber is the continued growth in popularity of cold rubber, which in 1956 accounted for 76.1 per cent of copolymer production compared with 72.0 per cent in 1955, 67.6 per cent in 1954, and 62.0 per cent in 1953. Cold rubber production in 1956 showed a gain in all sub-types except oil-extended black masterbatches. "Hot" S-type has dwindled steadily in importance, and the trend continues under private ownership of the plants.

The copolymer tonnage of cold rubber produced in the form of oil-extended S-type has increased every year since 1952, although the percentage of total cold rubber that was oil-extended dropped from its peak of 40.4 per cent in 1954 to 35.7 per cent in 1955 and 33.8% in 1956. In 1955 and 1956, total production of S-type rubber was greatly in excess of 1954, attaining new high records each year.

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action at processing temperatures

**FAST**
action at cure temperatures

**RELIABLE**
cure properties and physical results

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# PRICES OF COMMERCIALLY AVAILABLE SYNTHETIC RUBBER POLYMERS

*(dry types—per pound carload unless otherwise specified)*

### Butadiene-Acrylonitrile Types

| | |
|---|---|
| Butaprene NAA | .5400 [1] |
| Butaprene NF | .4900 [1] |
| Butaprene NL | .5000 [1] |
| Butaprene NXM | .5800 [1] |
| Chemigum N1 | .6400 [3] |
| Chemigum N3 | .5800 [3] |
| Chemigum N5 | .5800 [3] |
| Chemigum N6 | .5000 [3] |
| Chemigum N7 | .5000 [3] |
| Hycar 1001 | .5800 [3] |
| Hycar 1002 | .5000 [3] |
| Hycar 1014 | .6000 [3] |
| Hycar 1041 | .5800 [3] |
| Hycar 1042 | .5000 [3] |
| Hycar 1043 | .5000 [3] |
| Hycar 1312 | .5000 [3] |
| Hycar 1411 | .6200 [3] |
| Hycar 1432 | .5900 [3] |
| Hycar 1441 | .6200 [3] |
| Paracril AJ | .4850 [3] |
| Paracril B | .5000 [3] |
| Paracril BJ | .5000 [3] |
| Paracril BLT | .5000 [3] |
| Paracril C | .5800 [3] |
| Paracril CV | .5900 [3] |
| Paracril D | .6500 [3] |
| Paracril 18-80 | .6000 [3] |
| Polysar Krynac 800 | .5000 [3] |
| Polysar Krynac 801 | .5800 [3] |
| Polysar Krynac 802 | .5000 [3] |
| Polysar Krynac 803 | .5000 [3] |

### Butadiene-Styrene Types

| | |
|---|---|
| Ameripol 1000 | .2410 [3] |
| Ameripol 1001 | .2410 [3] |
| Ameripol 1002 | .2435 [3] |
| Ameripol 1006 | .2410 [3] |
| Ameripol 1007 | .2425 [3] |
| Ameripol 1009 | .2475 [3] |
| Ameripol 1500 | .2410 [3] |
| Ameripol 1501 | .2410 [3] |
| Ameripol 1502 | .2410 [3] |
| Ameripol 1703 | .2060 [3] |
| Ameripol 1705 | .2035 [3] |
| Ameripol 1707 | .1910 [3] |
| Ameripol 1708 | .1910 [3] |
| Ameripol 1710 | .1885 [3] |
| Ameripol 1712 | .1885 [3] |
| ASRC 1000 | .2410 [3] |
| ASRC 1001 | .2410 [3] |
| ASRC 1004 | .2410 [3] |
| ASRC 1006 | .2410 [3] |
| ASRC 1018 | .2700 [3] |
| ASRC 1019 | .2650 [3] |
| ASRC 1500 | .2410 [3] |
| ASRC 1502 | .2410 [3] |
| ASRC 1503 | .2625 [3] |
| ASRC 1703 | .2060 [3] |
| ASRC 1708 | .1910 [3] |
| Baytown 1600 | .1760 [3] |
| Baytown 1601 | .1760 [3] |
| Baytown 1602 | .1760 [3] |
| Baytown 1801 | .1600 [3] |
| Copo 1500 | .2410 [3] |
| Copo 1502 | .2410 [3] |
| Copo 1505 | .2610 [3] |
| Copo 1712 | .1885 [3] |
| FR-S 1000 | .2410 [3] |
| FR-S 1001 | .2410 [3] |

### Butadiene-Styrene (Cont'd)

| | |
|---|---|
| FR-S 1004 | .2410 [3] |
| FR-S 1006 | .2410 [3] |
| FR-S 1009 | .2475 [3] |
| FR-S 1010 | .2600 [3] |
| FR-S 1012 | .2425 [3] |
| FR-S 1013 | .2500 [3] |
| FR-S 1014 | .2810 [3] |
| FR-S 1015 | .2910 [3] |
| FR-S 1500 | .2410 [3] |
| FR-S 1502 | .2410 [3] |
| FR-S 1703 | .2060 [3] |
| FR-S 1705 | .2035 [3] |
| FR-S 1712 | .1885 [3] |
| Naugapol 1016 | .2650 [3] |
| Naugapol 1018 | .2700 [3] |
| Naugapol 1019 | .2650 [3] |
| Naugapol 1021 | .3000 [3] |
| Naugapol 1022 | .2800 [3] |
| Naugapol 1023 | .2850 [3] |
| Naugapol 1503 | .2625 [3] |
| Naugapol 1504 | .2950 [3] |
| Philprene 1000 | .2410 [1] |
| Philprene 1001 | .2410 [1] |
| Philprene 1006 | .2410 [1] |
| Philprene 1009 | .2475 [1] |
| Philprene 1010 | .2600 [1] |
| Philprene 1018 | .2700 [1] |
| Philprene 1019 | .2650 [1] |
| Philprene 1100 | .1940 [1] |
| Philprene 1104 | .1900 [1] |
| Philprene 1500 | .2410 [1] |
| Philprene 1502 | .2410 [1] |
| Philprene 1503 | .2625 [1] |
| Philprene 1600 | .1930 [1] |
| Philprene 1601 | .1930 [1] |
| Philprene 1605 | .1900 [1] |
| Philprene 1703 | .2060 [1] |
| Philprene 1706 | .2030 [1] |
| Philprene 1708 | .1910 [1] |
| Philprene 1712 | .1880 [1] |
| Philprene 1803 | .1740 [1] |
| Plioflex 1006 | .2410 [3] |
| Plioflex 1500 | .2410 [3] |
| Plioflex 1502 | .2410 [3] |
| Plioflex 1703 | .2060 [3] |
| Plioflex 1710 | .1885 [3] |
| Plioflex 1712 | .1885 [3] |
| Plioflex 1773 | .2060 [3] |
| Plioflex 1778 | .1910 [3] |
| Polysar Kryflex 200 | .2410 [3] |
| Polysar Krylene | .2410 [3] |
| Polysar Krylene NS | .2410 [3] |
| Polysar Krynol 651 | .1885 [3] |
| Polysar Krynol 652 | .1910 [3] |
| Polysar S | .2410 [3] |
| Polysar S-50 | .2410 [3] |
| Polysar S-X 371 | .2550 [3] |
| Polysar SS-250 | .3000 [3] |
| S-1000 | .2300 [2] |
| S-1001 | .2300 [2] |
| S-1002 | .2325 [2] |
| S-1006 | .2300 [2] |
| S-1011 | .2325 [2] |
| S-1013 | .2300 [2] |
| S-1100 | .1850 [2] |
| S-1500 | .2300 [2] |
| S-1502 | .2300 [2] |
| S-1600 | .1825 [2] |
| S-1601 | .1825 [2] |
| S-1602 | .1825 [2] |

### Butadiene-Styrene (Cont'd)

| | |
|---|---|
| S-1703 | .1950 [2] |
| S-1706 | .1925 [2] |
| S-1707 | .1800 [2] |
| S-1709 | .1775 [2] |
| S-1712 | .1775 [2] |
| S-1801 | .1675 [2] |
| Synpol 1000 | .2410 [1] |
| Synpol 1001 | .2410 [1] |
| Synpol 1002 | .2435 [1] |
| Synpol 1006 | .2410 [1] |
| Synpol 1007 | .2410 [1] |
| Synpol 1009 | .2475 [1] |
| Synpol 1012 | .2425 [1] |
| Synpol 1013 | .2500 [1] |
| Synpol 1061 | .2410 [1] |
| Synpol 1500 | .2410 [1] |
| Synpol 1502 | .2410 [1] |
| Synpol 1551 | .2410 [1] |
| Synpol 1703 | .2060 [1] |
| Synpol 1707 | .1910 [1] |
| Synpol 1708 | .1910 [1] |
| Synpol 1711 | .1900 [1] |

### Butyl Rubbers

| | |
|---|---|
| Enjay Butyl 035 | .2300 [3] |
| Enjay Butyl 150 | .2300 [3] |
| Enjay Butyl 165 NS | .2400 [3] |
| Enjay Butyl 215 | .2300 [3] |
| Enjay Butyl 217 | .2300 [3] |
| Enjay Butyl 218 | .2300 [3] |
| Enjay Butyl 268 NS | .2400 [3] |
| Enjay Butyl 325 | .2300 [3] |
| Enjay Butyl 365 NS | .2400 [3] |
| Polysar Butyl 100 | .2450 [3] |
| Polysar Butyl 101 | .2275 [3] |
| Polysar Butyl 200 | .2450 [3] |
| Polysar Butyl 300 | .2450 [3] |
| Polysar Butyl 301 | .2550 [3] |
| Polysar Butyl 400 | .2450 [3] |

### Neoprene

| | *(prices f.o.b.)* |
|---|---|
| Neoprene Types AC and CG | .5500 [2] |
| Neoprene Type GN | .4100 [2] |
| Neoprene Type GN-A | .4100 [2] |
| Neoprene Type GRT | .4200 [2] |
| Neoprene Type KNR | .7500 [2] |
| Neoprene Type S | .4200 [2] |
| Neoprene Type W | .3900 [2] |
| Neoprene Type WHV | .3900 [2] |
| Neoprene Type WRT | .4500 [2] |
| Neoprene Type WX | .4100 [2] |

### Silicone Rubbers*

| | *(prices f.o.b.)* |
|---|---|
| GE (compounded) | 2.50 [3] |
| GE Silicone Gum (not compounded) | 4.00 [3] |
| Silastic (compounded) | 1.90 [3] |
| Silastic (gums) | 3.85 [3] |
| Union Carbide (gums) | 4.00 [3] |
| Union Carbide (compounds) | 2.50 [3] |

### Polysulfide Rubbers

| | *(prices f.o.b.)* |
|---|---|
| Thiokol Type A | .4700 [2] |
| Thiokol Type FA | .6400 [2] |
| Thiokol PR-1 | .9500 [2] |
| Thiokol Type ST | 1.00 [2] |

*(latices—all prices per pound dry weight)*

### Butadiene-Acrylonitrile Types

| | |
|---|---|
| Butaprene N-300 | .4600 [1] |
| Butaprene N-400 | .5400 [1] |
| Butaprene N-401 | .5400 [1] |
| Chemigum 200 | .4900 [3] |
| Chemigum 235 | .5400 [3] |
| Chemigum 236 | .5400 [3] |
| Chemigum 245 | .4600 [3] |
| Chemigum 246 | .4600 [3] |
| Hycar 1512 | .4600 [3] |
| Hycar 1551 | .5400 [3] |
| Hycar 1552 | .4600 [3] |
| Hycar 1561 | .5400 [3] |
| Hycar 1562 | .4600 [3] |
| Hycar 1571 | .5400 [3] |
| Hycar 1572 | .5100 [3] |
| Hycar 1577 | .4600 [3] |
| Hycar 1852 | .4400 [3] |

### Butadiene-Styrene Types

| | |
|---|---|
| Copo 2101 | .3000 [3] |
| Copo 2102 | .3200 [3] |

### Butadiene-Styrene (Cont'd)

| | |
|---|---|
| Copo 2105 | .3200 [3] |
| Copo X-765 | .3000 [3] |
| FR-S 2000 | .2600 [3] |
| FR-S 2001 | .2600 [3] |
| FR-S 2002 | .2850 [3] |
| FR-S 2003 | .2950 [3] |
| FR-S 2004 | .2950 [3] |
| FR-S 2006 | .2660 [3] |
| FR-S 2105 | .3100 [3] |
| Pliolite 2101 | .3000 [3] |
| Pliolite 2104 | .3260 [3] |
| Pliolite 2105 | .3200 [3] |
| Pliolite X-765 | .3000 [3] |
| Naugatex 2000 | .2630 [3] |
| Naugatex 2001 | .2630 [3] |
| Naugatex 2002 | .2880 [3] |
| Naugatex 2006 | .2630 [3] |
| Naugatex 2105 | .3120 [3] |
| Naugatex X-765 | .2960 [3] |
| Naugatex X-767 | .3120 [3] |

### Butadiene-Styrene (Cont'd)

| | |
|---|---|
| S-2000 | .2275 [3] |
| S-2006 | .2150 [3] |
| S-2101 | .2250 [3] |
| S-2105 | .3100 [3] |

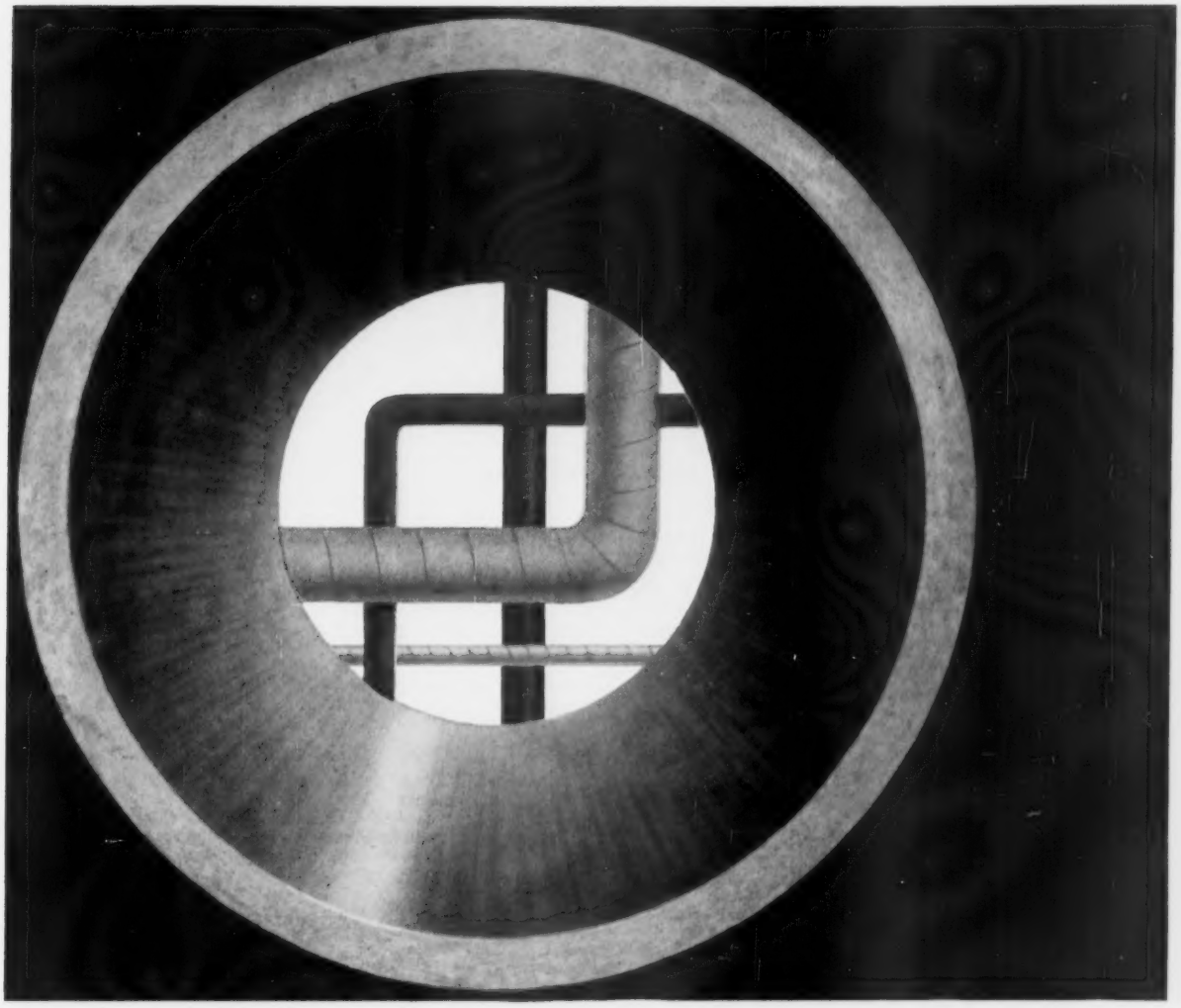
### Neoprene

| | |
|---|---|
| Neoprene Latex 60 | .4000 [3] |
| Neoprene Latex 571 | .3700 [3] |
| Neoprene Latex 572 | .3900 [3] |
| Neoprene Latex 601-A | .4000 [3] |
| Neoprene Latex 735 | .3800 [3] |
| Neoprene Latex 736 | .3800 [3] |
| Neoprene Latex 842-A | .3700 [3] |
| Neoprene Latex 950 | .4700 [3] |

### Polysulfide Rubbers

| | |
|---|---|
| Thiokol Type MX | .7000 [3] |
| Thiokol Type WD-2 | .9200 [3] |
| Thiokol Type WD-6 | .7000 [3] |

Notes: (1) Freight allowed. (2) Freight extra. (3) Freight prepaid. *Covers a wide range of compounds. Readers are urged to check specific prices with producers.



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# MARKETS

(continued)

## Reclaimed Rubber

In any periodic market review, it is well to examine, from time-to-time, the over-all influences which hold true. While abnormally large postwar needs brought a marked expansion in the output and consumption of reclaim, a declining trend soon became evident. This declining trend held, with the exception of the Korean War years and in 1955 when demand conditions were high.

While we speak of a declining trend, it is apparent the consumption ratio for reclaim will continue to hold at fairly steady levels since reclaim's percentage share is based upon ever rising new rubber consumption. The consensus is that reclaim will always hold an important place in the rubber industry. Price stability contributes to its value. From the technical point of view, it continues to excel for some uses, mainly in the mechanical goods field. So then, while no major gains are anticipated, the industry can still look forward to a fairly stable level of activity.

*(Prices for All Areas Except Calif.)*

| | per lb. |
|---|---|
| Premium Grade Whole Tire | .11½ |
| First Line Whole Tire | .11 |
| Second Line Whole Tire | .10½ |
| Third Line Whole Tire | .10¼ |
| Fourth Line Whole Tire | .09¼ |
| Black Carcass | .15¼ |
| No. 1 Light Colored Carcass | .22 |
| No. 1 Peel | .11 |
| Butyl Tube Reclaim | .14 |
| Natural Rubber Black Tube | .16 |
| Natural Rubber Red Tube | .21 |
| Natural Rubber Gray Tube | .21 |

## Scrap Rubber

The scrap rubber market continues on its lack-luster path, with slow trading the only characteristic feature. Some routine activity has been noted in the tube section of the market. Reports state that reclaimers are still working on curtailed schedules reflecting the slackened demand for reclaim. This, of course, is reflected in scrap rubber activities.

Early in the period some heightening of activity was noted in butyl tubes. The center of the market seems to be revolving about mixed automobile tire orders for June shipment. Nearing vacation schedules on the part of most reclaimers may cause some acceleration of the scrap rubber market in the next few weeks. However, a tapering-off process is likely with the market resuming its uneventful course. Despite the lack of volume business, scrap rubber prices, with few exceptions, remain at previously established levels. Current prices follow:

*(Prices Delivered Akron)*

| | | |
|---|---|---|
| Mixed tires | ton | 16.00 |
| Light colored carcass | lb. | .05½ |
| No. 1 peelings | ton | 45.00 |
| No. 2 peelings | ton | 30.00 |
| No. 3 peelings | ton | 20.00 |
| Buffings | ton | 16.00 |
| Truck and Bus S.A.G. | ton | 19.00 |
| Passenger S.A.G. | ton | 17.50 |
| Natural Rubber Red Tubes | lb. | .07¼ |
| Natural Rubber Black Tubes | lb. | .07 |
| Butyl Rubber Tubes | lb. | .04½ |

## Tire Fabrics

According to the Bureau of the Census, production of tire cord and tire fabric during the first quarter of 1957 was 123,182,000 pounds. This was 17 per cent higher than the previous quarter, but 5 per cent below the first quarter of 1956. The Census Bureau reports that the output of rayon tire cord and tire cord fabric rose 20 per cent from the previous quarter's level to 90,678,000 pounds.

During the same periods, production of nylon tire cord and tire cord fabric increased 8 per cent to 18,027,000 pounds. Production of cotton tire cord and tire cord fabric (excluding chafer fabrics) decreased 1 per cent. Stocks of tire cord and tire cord fabric on March 31, 1957, totaled 48,997,000 pounds, 3 per cent below the December 29, 1956, level, and 22 per cent less than stocks on March 31, 1956.

### Rayon Cord Predominates

As will be seen from the aforementioned statistics, rayon tire cord holds the lion's share of the market at the present time. A recent industry survey conducted by the American Viscose Corp. showed that more than 99 per cent of the new cars produced this year, 238 of the 240 various automobile models offered, will be factory equipped with tires reinforced by rayon cord.

It was pointed out that the automobile industry's predicted market of 6 million passenger vehicles for this year will require more than 30 million new tires as original equipment.

In commenting on this situation, George Storm, vice-president and general manager of the Rayon Division of American Viscose, observed that the rayon cord industry has grown with the automobile market. He pointed out that manufacturers adopted rayon cord for general use at the end of World War II and, in the ten years following the war's end, virtually every new car produced was equipped with rayon cord tires at the factories.

"Rayon research has kept pace with automotive requirements by steadily increasing tensile strength and flexibility of tire cord for the heavier, more powerful new cars," Mr. Storm said, adding that the rayon cord now in production "is 50 per cent stronger than rayon cord used in tires two years ago." Five companies produce rayon cord for the tire industry in this country. About one-third of their total cord output will go into original equipment tires in 1957, with the remainder marked for the replacement tire market.

*(Prices f.o.b. Shipping Point)*

**Rayon Tire Cord**

| | | |
|---|---|---|
| 1100 | lb. | .73 |
| 1650 | lb. | .67 |
| 2200 | lb. | .67½ |

**Nylon Tire Cord**

| | | |
|---|---|---|
| 210 | lb. | 1.95 |
| 840 | lb. | 1.80 |

**Rayon Graded Fabric**

| | | |
|---|---|---|
| 100 | lb. | .69 |
| 1650 | lb. | .63½ |
| 2200 | lb. | .63 |

**Cotton Chafers**

| | | |
|---|---|---|
| 8.9 oz. (per square yard) | lb. | .68 |
| 9.25 oz. (per square yard) | lb. | .66 |
| 11.65 oz. (per square yard) | lb. | .62 |
| 14.4 oz. (per square yard) | lb. | .71 |

## Liquid Latex

**Natural:** The Commerce Department reports that the increased demand for natural latex has resulted in a constantly larger portion of world production of natural rubber being shipped as latex, diminishing the amount of natural rubber produced in dry forms. Although the demand for natural latex since 1949 has been more rapid in foreign countries than in the U. S., the U. S. still accounts for over half the world consumption.

The principal reason for the more rapid growth abroad is that only small quantities of synthetic latices have been used there. In the U. S., demand for natural latex has been retarded by the more rapid increase in the consumption of synthetic latices.

Before World War II, natural latex was used 100 per cent for the manufacture of latex products throughout the world. In the U. S., natural latex accounted for over 59 per cent of latex consumption in the peak postwar year of 1950; it averaged 53.6 per cent in 1951-55, and fell to a postwar low of 48.2 per cent in 1956. The price levels of natural and synthetic latices probably contributed to this situation. Natural latex is currently selling at about 38c a pound at East Coast ports in car load quantities.

**Synthetic:** Despite the lack of statistics on foreign imports and consumption of synthetic latices, it appears that there is a large opportunity for increased consumption outside the U. S., particularly of the S-types. In France, for example, synthetic latices have not yet exceeded 7 per cent of total latex consumption.

The need and the opportunity for increased use of synthetic latices abroad are apparent. A gradual increase can be expected and the process should be hastened by good sales promotion, particularly with respect to cold S-type latices.

## Cotton

The price of middling uplands on the New York Cotton Exchange has moved in the extremely low range of 25 points since our last report (May 1), high for the period being 35.55c reached on May 20, 21 and 22, and low being 35.30c reached on May 14. The average price of middling uplands for the month of May was 35.40c based on 22 trading days. This compares with an average of 35.43c in the previous month.

Legislation calling for a drastically new method of aiding American cotton producers has been introduced in Congress by Senator R. B. Russell (Dem., Ga.) and Representative J. L. Whitten (Dem., Miss.). The new plan calls for the elimination of all controls on cotton production and the movement of cotton from the farm through domestic trade channels at world prices.

To offset the difference between the high cost of producing cotton here and abroad, farmers would receive certificates representing each farm's share of the domestic quota. The value of these certificates would be equal to the difference between the world price and an amount to be determined by the Secretary of Agriculture. Domestic quotas would be established on the five-year average production, 1952-57. Adjustments are provided for abnormal weather conditions.

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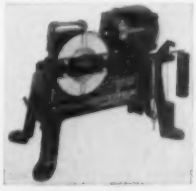

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# MARKET PRICES

## CHEMICALS & COMPOUNDING INGREDIENTS

**JUNE 1, 1957**

Prices are, in general, f.o.b. works and cover the domestic markets only. Export prices, as a rule, are usually slightly higher, due to packing regulations, special handling, etc.

Abbreviations: bbls., barrels; c.l., carload; cyl., cylinder; dlvd., delivered; dms., drums; eqld., equalized; l.c.l., less than carload; M.B. masterbatch; min., minimum; ref., refined; sap., saponified; sp., special; syn., synthetic; t.c., tank cars.

*Trademark. †For Export Only.

The arrangement of this section closely follows the Chemical Section of the 1955-56 RUBBER RED BOOK. Readers are referred to that edition for the correct classification of any material or brand name. Suppliers of every material are contacted for price information. However, only those materials are listed for which quotations have been furnished within the past six months. The quotations are not guaranteed and prospective purchasers should contact suppliers for information. Suppliers are requested to send current price information to the Market Editor, RUBBER AGE.

### ACCELERATORS

| | | | |
|---|---|---|---|
| A-1 (Thiocarbanilide)* | lb. | .72 | .79 |
| A-32* | lb. | .66 | .80 |
| A-100* | lb. | .52 | .66 |
| Accelerator No. 8* | lb. | — | 1.10 |
| Accelerator—49* | lb. | .57 | .58 |
| Accelerator 89* | lb. | — | 1.20 |
| Accelerator 108* | lb. | — | .90 |
| Accelerator—552* | lb. | — | 2.25 |
| Accelerator—808* | lb. | .66 | .68 |
| Accelerator—833* | lb. | 1.17 | 1.19 |
| Accelerator B* | lb. | — | .89 |
| Altax* | lb. | .52 | .54 |
| Ancap*(†) | lb. | .38 | .40 |
| Ancatax*(†) | lb. | .48 | .50 |
| Ancazate BU (ET & ME)*(†) | lb. | — | 1.07 |
| Ancazide ET*(†) | lb. | — | 1.07 |
| ME*(†) | lb. | — | 1.14 |
| Arazate* | lb. | — | 2.25 |
| Arquad 12* | lb. | .55 | .61 |
| Beutene* | lb. | .66 | .68 |
| Bismate, Rodform* | lb. | — | 3.00 |
| Butazate* | lb. | — | 1.04 |
| Butyl Eight* | lb. | 1.10 | 1.35 |
| Butyl Namate | lb. | .45 | .50 |
| Butyl, Ethyl & Methyl Zimate Slurry (50% solids content) | lb. | .85 | .89 |
| Captax* | lb. | .42 | .44 |
| C-P-B* | lb. | — | 1.95 |
| Cumate, Rodform* | lb. | — | 1.45 |
| Diorthotolylguanidine | lb. | .62 | .63 |
| Dipac* | lb. | — | .85 |
| Diphenylguanidine | lb. | .52 | .58 |
| El-Sixty* | lb. | .60 | .67 |
| Ethazate* | lb. | — | 1.04 |
| 50D* | lb. | — | .85 |
| Ethyl Thiurad* | lb. | — | 1.04 |
| Ethyl Tuex* | lb. | — | 1.04 |
| Ethylac* | lb. | .93 | .95 |
| Guantal* | lb. | .60 | .67 |
| Harvex* | lb. | .70 | .76 |
| Hepteen Base* | lb. | — | 1.85 |
| Kure-Blend MT* | lb. | — | .70 |
| Ledate, Rodform* | lb. | — | 1.04 |
| MBT-XXX* | lb. | .53 | .55 |
| Merac* | lb. | .75 | 1.05 |
| Mercaptobenzothiazole | lb. | .42 | .44 |
| Mercaptobenzothiazyl Disulfide | lb. | .52 | .54 |
| Mertax* | lb. | .53 | .60 |
| Methazate* | lb. | — | 1.04 |
| Monex* | lb. | — | 1.14 |
| Mono Thiurad* | lb. | — | 1.14 |
| Morfex* | lb. | .65 | .67 |
| 2-MT | lb. | — | 1.00 |
| NA-22* (for neoprene) | lb. | — | 1.00 |
| NOBS No. 1* | lb. | .74 | .76 |
| Special* | lb. | .79 | .81 |
| O-X-A-F | lb. | .53 | .55 |
| Pentex* | lb. | — | 1.04 |
| Flour* | lb. | — | .26 |
| Permalux (Neoprene)* | lb. | — | 2.17 |
| Phenex* | lb. | .52 | .57 |
| Polyac* | lb. | — | 1.85 |
| R-2 Crystals* | lb. | — | 4.35 |
| Rotax* | lb. | .53 | .55 |
| RZ-50-A* | lb. | — | 1.60 |
| B* | lb. | — | 1.00 |
| Santocure* | lb. | .74 | .81 |
| NS* | lb. | .79 | .86 |
| Selenac* (Ethyl, Methyl) | lb. | — | 4.25 |
| Seleram, Ethyl | lb. | — | 4.25 |
| Setsit-5* | lb. | .75 | 1.05 |
| 9* | lb. | .85 | 1.15 |
| SPDX-GH* | lb. | .69 | .71 |
| GL* | lb. | 1.20 | 1.30 |
| Tellurac* | lb. | — | 1.45 |
| Tepidone* | lb. | .45 | .48 |
| Tetrone A* | lb. | — | 1.91 |
| Thiotate* | lb. | .52 | .59 |
| S* | lb. | .62 | .69 |
| Thionex* | lb. | — | 1.14 |
| Thiotax* | lb. | .42 | .49 |
| Thiram, Ethyl | lb. | — | 1.04 |
| Methyl | lb. | — | 1.14 |
| Thiurad* | lb. | — | 1.14 |
| Thiuram E* | lb. | — | 1.04 |
| M* | lb. | — | 1.14 |
| Trimene* | lb. | .56 | .58 |
| Base* | lb. | 1.03 | 1.06 |
| Triphenyl Guanidine | lb. | — | .90 |
| Tuads* (Ethyl) | lb. | — | 1.04 |
| Tuads* (Methyl) | lb. | — | 1.14 |
| Tuex* | lb. | — | 1.14 |
| Ultex* | lb. | 1.00 | 1.10 |
| Unads* | lb. | — | 1.14 |
| ZB* | lb. | — | .85 |
| ZE* | lb. | — | .85 |
| ZM* | lb. | — | .85 |
| Vimbra | lb. | .32 | .38½ |
| Vulcacure NB* | lb. | .45 | .45 |
| NS* | lb. | .75 | 1.05 |
| ZB*, ZE*, ZM* | lb. | .85 | .89 |
| Z-B-X* | lb. | — | 2.45 |
| Zenite* | lb. | .52 | .54 |
| A* | lb. | .62 | .64 |
| Zenite Special* | lb. | .53 | .55 |
| Zetax* (uncoated) | lb. | .53 | .55 |
| Zimate* (Butyl) | lb. | — | 1.04 |
| Zimate* (Ethyl) | lb. | — | 1.04 |
| Zimate* (Methyl) | lb. | — | 1.04 |
| Ziram, Butyl | lb. | — | 1.04 |
| 50% Dispersion | lb. | .87 | .89 |
| Ziram, Ethyl | lb. | — | 1.04 |
| 50% Dispersion | lb. | .87 | .89 |
| Ziram, Methyl | lb. | — | 1.04 |
| 50% Dispersion | lb. | .87 | .89 |

### ACTIVATORS

| | | | |
|---|---|---|---|
| Blue Lead, Sublimed (dlvd.) | lb. | .17¼ | .18¼ |
| Cottonseed Fatty Acids | | | |
| Wochem 210* | lb. | — | .15¾ |
| 211* | lb. | — | .15¾ |
| Fish Oil, Hydrogenated, Fatty Acid | | | |
| DAR-S* (dlvd.) | lb. | .13½ | .13¾ |
| DAR-HY* (dlvd.) | lb. | .14¼ | .16¾ |
| Hydrofol Acids* (dlvd.) | lb. | .15¼ | .17¼ |
| Hyfac 430* (dlvd.) | lb. | .16¾ | .19½ |
| Neo-Fat H.F.O.* (dlvd.) | lb. | .14½ | .15¾ |
| Neutrex* (dlvd.) | lb. | .15 | .17 |
| Stearex Beads* (dlvd.) | lb. | .09¾ | .10¼ |
| Stearite* | lb. | .12 | .14 |
| Talene* (dlvd.) | lb. | .13½ | .17¼ |
| Lime, Hydrated | | | |
| Arrowhead* | ton | — | 21.00 |
| Marblehead* | ton | — | 17.75 |
| Sierra* | ton | — | 22.50 |
| Litharge | | | |
| Eagle-Picher* (c.l.) | lb. | .18 | — |
| SB* (dlvd.) | lb. | — | .18½ |
| Magnesium Oxide, Heavy | | | |
| General Magnesite 500* | lb. | .05½ | .06 |
| 600* | lb. | .06½ | .07 |
| Kaiser 325* | lb. | .057 | .073 |
| Michigan No. 15* | lb. | .05½ | .06½ |
| Magnesium Oxide, Light | | | |
| Carey Mag* | lb. | .25¼ | .26 |
| General Magnesite* (neoprene grade) | lb. | .30 | .32 |
| General Magnesite No. 101* | lb. | .25¼ | .26 |
| Genmeg MLW* | lb. | .25¼ | .26 |
| K & M* (neoprene grade) | lb. | .29¼ | .30 |

### ACTIVATORS (Cont'd)

| | | | |
|---|---|---|---|
| Magnesium Oxide, Light (cont'd) | | | |
| Light Calcined Magnesia No. X-01* | lb. | .25¼ | .26 |
| Maglite D* | lb. | .25¼ | .26 |
| L and M* | lb. | .29¼ | .30 |
| Michigan No. 30* | lb. | .25¼ | .26 |
| Neomag Powder* | lb. | .29¼ | .30 |
| Pellets* | lb. | .31¾ | .32 |
| Michigan No. 40* | lb. | .29¼ | .30 |
| Oleic Acid | | | |
| Emersol 210* (dlvd.) | lb. | .18¾ | .20¾ |
| Groco Red Oil | lb. | .18¼ | .20¼ |
| Neo-Fat 92-04* | lb. | .20½ | .22½ |
| 94-04* | lb. | .18½ | .20½ |
| Wochem 310, 311 | lb. | — | .17¾ |
| Palm Fatty Acids | | | |
| Groco 45* | lb. | .15¾ | .17¾ |
| Neo-Fat* | lb. | .15¾ | .17¾ |
| Wochem 280* | lb. | — | .14¾ |
| 281* | lb. | — | .15¾ |
| Potassium Oleate (dms.) | lb. | .30 | .73 |
| Red Lead | | | |
| Eagle-Picher* (c.l.) | lb. | .19 | — |
| No. 2 RM* (dlvd.) | lb. | — | .18½ |
| Sodium Laurate, 75% | lb. | .64 | .89 |
| Sodium Oleate, 75% | lb. | .54 | .79 |
| Paste (dms.) | lb. | .39 | .64 |
| Sodium Stearate, 75% | lb. | .54 | .89 |
| Stearic Acid, Single Pressed | | | |
| Emersol 110* (dlvd.) | lb. | .14¾ | .17¾ |
| Groco 53* | lb. | .14¾ | .17¾ |
| Neo-Fat 18-53* | lb. | .14¾ | .16¾ |
| Standard Pearlstearic* (dlvd.) | lb. | .14¾ | .17¾ |
| Stearex B* (dlvd.) | lb. | .15½ | .16¾ |
| Wochem 730* | lb. | — | .11¼ |
| Stearic Acid, Double Pressed | | | |
| Choice Pearlstearic* (dlvd.) | lb. | .15¼ | .17¾ |
| Emersol 120* (dlvd.) | lb. | .15¼ | .17¾ |
| Groco 54* | lb. | .15¼ | .17¾ |
| Hydrofol Acid 51RG | lb. | .11¼ | .13¾ |
| Neo-Fat 18-54* | lb. | .15¼ | .17¾ |
| Wochem 731* | lb. | — | .14¼ |
| Stearic Acid, Other | | | |
| Extra Pearlstearic* (dlvd.) | lb. | .17½ | .20 |
| Groco* | lb. | .12 | .14 |
| Neo-Fat 18* | lb. | .18½ | .20½ |
| 18-58* | lb. | .14¼ | .16¾ |
| 18-61* | lb. | .16¼ | .18¾ |
| Stearite* | lb. | .11¾ | .13¼ |
| Wochem 720* | lb. | — | .10 |
| 721* | lb. | — | .10 |
| 732* | lb. | — | .15¼ |
| White Lead Basic Carbonate | lb. | .19 | .20 |
| White Lead Basic Sulfate | lb. | .17¼ | .18¼ |
| Zinc Laurate | | | |
| Laurex* | lb. | .33 | .34 |
| Zinc Stearate | lb. | .41 | .46 |
| Aquazinc K.C.* | lb. | .30 | .55 |
| Crown Brand* | lb. | .39 | .44 |

### Unclassified Activators

| | | | |
|---|---|---|---|
| Actifat* (dms.) | lb. | — | .18 |
| Aktone* | lb. | .21¼ | .23¼ |
| Barak* | lb. | — | .62 |
| Curade* | lb. | .57 | .59 |
| Dibenzo G-M-F | lb. | — | 2.60 |
| D-B-A* | lb. | — | 1.95 |
| G-M-F* | lb. | — | 2.60 |
| Dibutylamine (dlvd.) | lb. | .55½ | .56½ |
| MODX* | lb. | .32½ | .34½ |
| Neo Fat 42-07* | lb. | .10¾ | .12¼ |
| Ridacto* (dms.) | lb. | .25 | .26 |
| Snodotte* (dlvd.) | lb. | .19 | .21½ |
| Vulklor* | lb. | .88 | .98 |

### ANTI-COAGULANTS

| | | | |
|---|---|---|---|
| Aqua Ammonia* (dms.) | lb. | .031 | .035 |
| M.B.M.C.* (l.c.l.) | lb. | .54 | .76 |

### ANTI-FOAMING AGENTS

| | | | |
|---|---|---|---|
| Aero Anti Foam H* | lb. | — | .20 |
| Regular* | lb. | — | .12 |
| Anhydrol 6991* | lb. | .51 | .56 |
| D.C. Antifoam A* | lb. | 5.45 | 6.65 |
| Antifoam A Emulsion* | lb. | 2.05 | 4.00 |
| Antifoam AF Emulsion* | lb. | 2.05 | 2.85 |
| Defoama W-1701* | lb. | — | .12½ |
| Defoamer A-25* | lb. | — | 3.00 |
| Defoamer 630* | lb. | — | .14 |
| Deltyl Prime | lb. | .70 | .80 |

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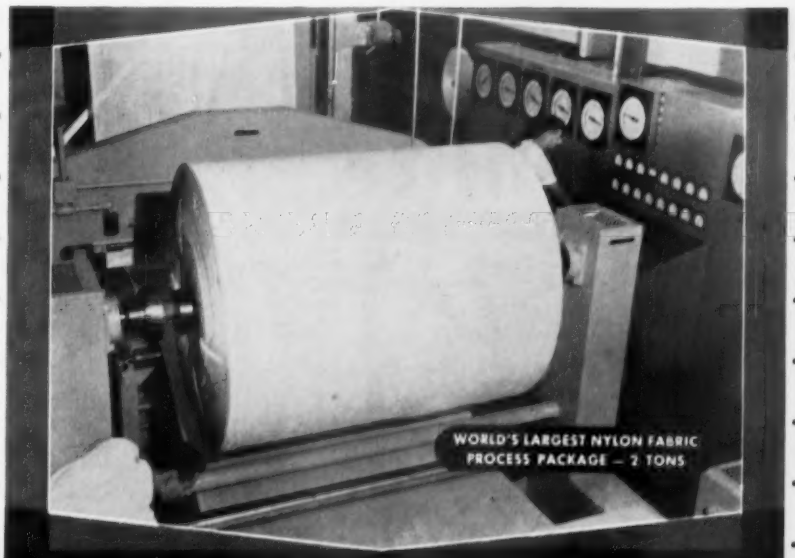


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EXPORT REPRESENTATIVE: GILLESPIE & CO. OF N. Y., 96 WALL ST., NEW YORK 5, N. Y.

## ANTI-FOAMING AGENTS (Cont'd)

| | | | | |
|---|---|---|---|---|
| G-E Antifoam SS-24* | lb. | 5.30 | - | 6.65 |
| SS-66* | lb. | 5.30 | - | 6.65 |
| 60 Emulsion* | lb. | 2.05 | - | 3.75 |
| Igepol CO-210 | lb. | — | - | .36 |
| Kessco X-3* (dms.) | lb. | — | - | .35 |
| X-180* | lb. | — | - | .29¼ |
| X-181* | lb. | — | - | .38½ |
| Napco 1407* | lb. | .19½ | - | .20½ |
| 1497-V* | lb. | .13¾ | - | .14¼ |
| 1907-B* | lb. | .18¼ | - | .19¾ |
| JMK* | lb. | .48 | - | .49 |
| JMU* | lb. | .22½ | - | .23½ |
| JMY* | lb. | .19¼ | - | .20¼ |
| Pluronic L61* | lb. | .33¼ | - | .39 |
| RS-968* | lb. | .38 | - | .38½ |
| Terpinol Prime No. 1 | lb. | .35 | - | .50 |
| Tributyl Phosphate (dms.) | lb. | .52½ | - | .53½ |

## ANTIOXIDANTS

| | | | | |
|---|---|---|---|---|
| Agebest 1293-22A* | lb. | 1.90 | - | 2.00 |
| AgeRite Alba* | lb. | 2.35 | - | 2.45 |
| Gel* | lb. | .67 | - | .69 |
| Hipar* | lb. | 1.00 | - | 1.02 |
| H.P.* | lb. | .76 | - | .78 |
| Powder* | lb. | .55 | - | .57 |
| Resin* | lb. | .82 | - | .84 |
| Resin D* | lb. | .55 | - | .57 |
| Spar* | lb. | .55 | - | .57 |
| Stalite* | lb. | .55 | - | .57 |
| Stalite S* | lb. | .55 | - | .57 |
| Superlite* | lb. | .55 | - | .57 |
| White* | lb. | 1.45 | - | 1.55 |
| Akroflex C* | lb. | .81 | - | .83 |
| CD* | lb. | .76 | - | .78 |
| Aminox* | lb. | .55 | - | .57 |
| Antioxidant 425* | lb. | 2.47 | - | 2.50 |
| Antioxidant 2246* | lb. | 1.50 | - | 1.53 |
| Antox* | lb. | .55 | - | .57 |
| Aranox* | lb. | — | - | 3.25 |
| Benzoquinone | lb. | 1.50 | - | 1.75 |
| Betanox Special* | lb. | .85 | - | .87 |
| B-L-E* | lb. | .55 | - | .57 |
| B-X-A* | lb. | .55 | - | .57 |
| Deenax* | lb. | .95 | - | 1.05 |
| Di-tert-Butyl-para-Cresol | lb. | .86 | - | 1.16 |
| Eugenol C-95%* | lb. | 2.30 | - | 2.50 |
| Flectol H* | lb. | .55 | - | .62 |
| Flexamine* | lb. | .76 | - | .78 |
| Ionol* (dms.) | lb. | .91 | - | .95 |
| Neozone A* | lb. | .59 | - | .61 |
| C* | lb. | — | - | .83 |
| D* | lb. | .55 | - | .57 |
| Nevastain A* | lb. | .51 | - | .61 |
| B* | lb. | .51 | - | .70 |
| Nullapon BF-12* | lb. | — | - | .21½ |
| BF-13* | lb. | — | - | .25½ |
| BF-78* | lb. | — | - | .55 |
| BF-Acid* | lb. | — | - | .85 |
| Octamine* | lb. | .55 | - | .57 |
| Oxidex* | lb. | — | - | 3.60 |
| PDA-10* | lb. | .46 | - | .48 |
| Permalux* | lb. | — | - | 2.17 |
| Polygard* | lb. | .55 | - | .57 |
| Santoflex AW* | lb. | .78 | - | .85 |
| DD* | lb. | .55 | - | .62 |
| 75* | lb. | .97 | - | 1.04 |
| Santovar-A* | lb. | 1.50 | - | 1.57 |
| Santowhite Crystals* | lb. | 1.55 | - | 1.62 |
| Santowhite L* | lb. | .55 | - | .62 |
| MK* | lb. | 1.25 | - | 1.32 |
| Powder* | lb. | 1.55 | - | 1.62 |
| Sequestrene AA* | lb. | .76 | - | .85 |
| NA2* | lb. | .62 | - | .70 |
| NA3* | lb. | .61 | - | .69 |
| Stabilite* | lb. | .55 | - | .57 |
| Alba* | lb. | .72 | - | .77 |
| FLX* | lb. | — | - | .65 |
| L* | lb. | .60 | - | .62 |
| White* | lb. | .52 | - | .54 |
| White Powder* | lb. | .41 | - | .43 |
| Stabilizer No. 1* | lb. | 1.55 | - | 1.80 |
| Stabilizer No. 9-A* | lb. | .80 | - | 1.05 |
| Styphen I* | lb. | .51 | - | .55 |
| Sunolite* | lb. | .16 | - | .22 |
| Tannic Acid, Tech. | lb. | .46 | - | .48 |
| Thermoflex A* | lb. | 1.00 | - | 1.02 |
| V-G-B* | lb. | .75 | - | .77 |
| Wing-Stay S* | lb. | .53 | - | .57 |

## ANTI-SCORCHING AGENTS

| | | | | |
|---|---|---|---|---|
| Armeen HT* | lb. | .34 | - | .40 |
| Good-rite Vultrol* | lb. | .62 | - | .64 |
| Harcopel 1183* | lb. | .70 | - | .74 |
| Retarder PD* | lb. | .37 | - | .39 |
| W* | lb. | — | - | .42 |
| Sodium Acetate 60-62% Crystals | lb. | .08 | - | .08½ |

## ANTISEPTICS AND GERMICIDES

| | | | | |
|---|---|---|---|---|
| A.P.C. 6901* | lb. | .32 | - | .38 |
| Arquad S* | lb. | .38 | - | .44 |
| Formaldehyde (dms.) | lb. | .06 | - | .076 |
| G-4* (bbls.) | lb. | 1.09 | - | 1.29 |
| G-11* | lb. | 1.98 | - | 2.08 |
| Halane* | lb. | .40 | - | .47 |
| Ortho Cresol (26°—27°) | lb. | .14 | - | .16¼ |
| Preventol GD | lb. | — | - | 1.09 |
| Retarder D* | lb. | .42 | - | .50 |
| Vancide | lb. | — | - | .80 |

## ANTI-WEBBING AGENTS (for Latex)

| | | | | |
|---|---|---|---|---|
| DC 7 Compound* | lb. | 5.13 | - | 6.50 |
| Webnix 34-L* | lb. | 1.25 | - | 1.75 |
| 69-C* | lb. | 1.50 | - | 2.25 |

## AROMATICS (DEODORANTS)

| | | | | |
|---|---|---|---|---|
| Airkem 115* | gal. | — | - | 6.50 |
| 122* | gal. | — | - | 6.50 |
| 186* | gal. | — | - | 6.50 |
| Alamask AA* | lb. | — | - | 3.00 |
| AF* | lb. | — | - | 2.50 |
| AO* | lb. | — | - | 1.50 |
| AR* | lb. | — | - | .50 |
| BG* | lb. | — | - | 1.15 |
| BGM* | lb. | — | - | .60 |
| CY* | lb. | — | - | 2.40 |
| DJ* | lb. | — | - | 3.35 |
| DL* | lb. | — | - | 1.95 |
| H* | lb. | — | - | 5.50 |
| LD* | lb. | — | - | .75 |
| ND* | lb. | — | - | 2.75 |
| O* | lb. | — | - | 6.50 |
| OS* | lb. | — | - | 5.25 |
| Bouquet 149* | lb. | — | - | 3.00 |
| Coumarin* | lb. | 3.60 | - | 3.70 |
| Curodex 19* | lb. | 4.75 | - | 4.90 |
| 188* | lb. | 5.75 | - | 5.90 |
| 198* | lb. | 6.75 | - | 6.90 |
| Deodorant 65* | lb. | — | - | 1.85 |
| Deodorant L-37* | lb. | 2.15 | - | 2.25 |
| L-44* | lb. | 2.65 | - | 2.75 |
| N.L.T.X.* | lb. | 1.90 | - | 2.00 |
| Deodorant Oil GD 6422* | lb. | 1.90 | - | 2.20 |
| GD 6423* | lb. | 1.60 | - | 1.90 |
| GD 6575* | lb. | 2.40 | - | 2.90 |
| GD 31063* | lb. | 2.25 | - | 2.75 |
| Ethavan* | lb. | 6.20 | - | 6.25 |
| Latex Perfume 17326 | lb. | — | - | 4.00 |
| 18301 | lb. | — | - | 3.00 |
| 22258 | lb. | — | - | 2.50 |
| Naugaromes* (dms.) | lb. | .60 | - | 3.00 |
| Neutroleum Delta* | lb. | — | - | 2.60 |
| Gamma* | lb. | — | - | 3.60 |
| Parador A* | lb. | 1.80 | - | 2.10 |
| C* | lb. | 2.00 | - | 2.50 |
| E* | lb. | .25 | - | .40 |
| GD 5280* | lb. | 2.00 | - | 2.50 |
| GD 53481* | lb. | 1.70 | - | 2.00 |
| Perfume Oil Bouquet Vanilla M* | lb. | 1.60 | - | 1.70 |
| Rodo No. 0* | lb. | 4.00 | - | 4.50 |
| No. 10* | lb. | 5.00 | - | 5.50 |
| Rubbarome* (dms.) | lb. | .60 | - | 3.80 |
| Rubber Perfume 12* | lb. | — | - | 4.35 |
| Russian Leather 7* | lb. | — | - | 4.35 |
| Vanillin | lb. | 2.75 | - | 2.80 |

## BLOWING AGENTS

| | | | | |
|---|---|---|---|---|
| Ammonium Bicarbonate | cwt. | — | - | 8.00 |
| Better Blend Soda* (c.l., bags) | cwt. | — | - | 2.55 |
| Blowing Agent CP-975* | lb. | .32 | - | .35 |
| Celogen* | lb. | — | - | 1.95 |
| AZ* | lb. | — | - | 1.95 |
| Diazo Amino Benzene | lb. | — | - | .73 |
| Neo Fat 42-12* | lb. | .10¼ | - | .12¼ |
| Opex 40 | lb. | .75 | - | .76 |
| Sodium Bicarbonate, U.S.P. (c.l. bags) | cwt. | — | - | 2.40 |
| Sponge Paste* | lb. | — | - | .20 |
| Unicel ND* | lb. | — | - | .76 |
| S* | lb. | — | - | .20 |
| Urea | lb. | .06 | - | .07 |

## BONDING AGENTS

| | | | | |
|---|---|---|---|---|
| Base 6986* | lb. | .27 | - | .32 |
| Braze* | gal. | 6.00 | - | 9.00 |
| Cover Cement* | gal. | 2.50 | - | 4.00 |
| Durez 12987* | lb. | — | - | .54 |
| Gen-Tac Latex* | lb. | .70 | - | .75 |
| Hylene M* | lb. | 3.50 | - | 3.75 |
| M-50* | lb. | 1.90 | - | 2.15 |
| Penacolite B1A* | lb. | — | - | .95 |
| R-2710* | lb. | — | - | .95 |
| Pliobond 20* | gal. | 2.91 | - | 4.23 |
| 30* | gal. | 3.65 | - | 4.97 |
| Rex Compounds* | gal. | 1.30 | - | 1.90 |
| Thixons* | gal. | 3.30 | - | 9.00 |
| Ty-Ply Q (BN & S)* | gal. | 6.75 | - | 8.00 |
| Tygobond 30* | gal. | 5.50 | - | 7.45 |
| Vinculux | gal. | — | - | 4.95 |

## COAGULANTS

| | | | | |
|---|---|---|---|---|
| Acetic Acid—56% (bbls.) | cwt. | 9.00 | - | 11.00 |
| Glacial 99½% (dms.) | lb. | .12 | - | .13 |
| Calcium Nitrate, Tech. Flake | lb. | .12½ | - | .15 |
| Hydroxyacetic Acid—70% (dms.) | lb. | — | - | .09$ |
| Zinc Nitrate, Tech. Flake | lb. | — | - | .20 |

## COLORING AGENTS

### Black

| | | | | |
|---|---|---|---|---|
| Aquablak B* | lb. | .09¾ | - | .10¼ |
| M* | lb. | .10½ | - | .11 |
| R* | lb. | .10¾ | - | .11¼ |
| S* | lb. | .11¾ | - | .12¼ |
| Black Shield 4-35* (dms) | lb. | .09 | - | .09½ |
| No. 5 | lb. | .10 | - | .10½ |
| No. 6 | lb. | .09 | - | .09½ |
| L-1404B | lb. | .10½ | - | .11 |
| Carbon Black—See *Reinforcing Agents* | | | | |
| Cooke 1026* | lb. | — | - | 2.50 |
| Lampblack No. 10* | lb. | .06 | - | .09 |
| Mapico Black Iron Oxide* (50 lb. bags) | lb. | .14¼ | - | .14½ |
| Pure Black Iron Oxide | lb. | .14¼ | - | .14½ |

## COLORING AGENTS (Cont'd)

### Blue

| | | | | |
|---|---|---|---|---|
| Akron Masterbatches* | lb. | 2.23 | - | 2.78 |
| Toners* | lb. | 2.30 | - | 6.35 |
| Blue Powders | lb. | 2.20 | - | 3.75 |
| Cooke M.B. Blue* | lb. | 2.20 | - | 3.75 |
| Monastral Rubber Blue CPL* | lb. | — | - | 1.95 |
| PCD, Dispersed* | lb. | — | - | 2.20 |
| Peacoline Blue* | lb. | — | - | 3.85 |
| Ramapo Blue* | lb. | 2.75 | - | 3.00 |
| Rubber Blue GD* (Disp.) | lb. | — | - | 4.75 |
| Rubber Blue X-1999* | lb. | — | - | 1.90 |
| Rubber Dispersed Blues | lb. | 2.52 | - | 2.78 |
| Solfast Sky Blue* | lb. | 3.00 | - | 3.60 |
| Syntheline Blue* | lb. | — | - | 3.85 |
| Stan-Tone MBS* | lb. | 1.55 | - | 4.55 |
| GPE* | lb. | — | - | 2.50 |
| PC* | lb. | 1.40 | - | 1.80 |
| Ultramarine | lb. | .14 | - | .30 |
| Vansul Blue M.B.* | lb. | .95 | - | 2.60 |

### Brown

| | | | | |
|---|---|---|---|---|
| Brown Iron Oxide | lb. | .15¼ | - | .15½ |
| Mapico Brown* (50 lb. bags) | lb. | .15¼ | - | .15½ |
| Stan-Tone GPE* | lb. | — | - | 3.00 |
| Vansul Brown M.B.* (Organic) | lb. | — | - | 2.15 |

### Green

| | | | | |
|---|---|---|---|---|
| Akron Masterbatches* | lb. | 1.38 | - | 3.08 |
| Toners* | lb. | 1.35 | - | 4.95 |
| Cooke M.B. Green* | lb. | 1.60 | - | 2.80 |
| 1013* | lb. | — | - | 2.80 |
| Filo Green* | lb. | — | - | .34 |
| Green Powders | lb. | 1.35 | - | 3.95 |
| Monastral Rubber Green GSD* (Dispersed) | lb. | — | - | 2.66 |
| GSL* | lb. | — | - | 2.20 |
| Permansa Green CP-594* | lb. | — | - | 1.35 |
| Pigment Green B* | lb. | — | - | 1.35 |
| GL-652D* | lb. | .90 | - | 1.00 |
| Ramapo Green* | lb. | — | - | 3.50 |
| Rubber Dispersed Greens | lb. | 1.23 | - | 3.08 |
| Rubber Green FD* (Disp.) | lb. | — | - | 2.05 |
| Rubber Green X-1292* | lb. | — | - | 1.65 |
| Solfast Green* | lb. | — | - | 3.95 |
| Stan-Tone MBS* | lb. | 1.55 | - | 3.35 |
| GPE* | lb. | 3.00 | - | 4.50 |
| PC* | lb. | 1.70 | - | 3.80 |
| Vansul Green M.B.* | lb. | 1.05 | - | 2.90 |

### Maroon

| | | | | |
|---|---|---|---|---|
| Akron Masterbatches* | lb. | — | - | 4.10 |
| Toners* | lb. | 2.00 | - | 4.00 |
| Maroon Powders | lb. | .79 | - | 3.60 |
| Pyrolux Maroon* | lb. | — | - | 3.65 |
| Vansul Maroon M.B.* | lb. | — | - | 3.35 |

### Orange

| | | | | |
|---|---|---|---|---|
| Akron Masterbatches* | lb. | 2.42 | - | 2.77 |
| Toners* | lb. | 2.82 | - | 4.00 |
| Benzidene Orange | lb. | — | - | 3.00 |
| Cooke MB* | lb. | 2.25 | - | 2.35 |
| 1021* | lb. | — | - | 2.25 |
| Mercadium X-2667* | lb. | — | - | 1.78 |
| Molybdate Orange | lb. | .46½ | - | .48 |
| Oswego Orange X2065* | lb. | — | - | 3.15 |
| Rubber Orange OD* (Disp.) | lb. | — | - | 2.25 |
| Solfast Orange* | lb. | — | - | 2.25 |
| Stan-Tone Cadmium Dry* | lb. | 2.10 | - | 2.20 |
| Cadmium Paste* | lb. | 2.47 | - | 3.20 |
| GPE* | lb. | 1.20 | - | 4.35 |
| PC* | lb. | .75 | - | 2.75 |
| Vansul Orange M.B.* | lb. | 2.40 | - | 2.45 |

### Red

| | | | | |
|---|---|---|---|---|
| Akron Masterbatches* | lb. | 1.00 | - | 3.53 |
| Toners* | lb. | .88 | - | 5.60 |
| Arcturus Reds* | lb. | — | - | 1.13 |
| Antimony Trisulfide | lb. | .72 | - | .78 |
| R.M.P. Sulfur Free* | lb. | — | - | .78 |
| R.M.P. No. 3* | lb. | — | - | .72 |
| Brilliant Toning Reds* | lb. | 1.65 | - | 1.95 |
| Cadmolith Red* (dms.) | lb. | 2.10 | - | 3.23 |
| Cooke M.B. Red* | lb. | 1.05 | - | 3.25 |
| 1010* | lb. | — | - | 1.75 |
| Graphic Red (dlvd.) | lb. | .88 | - | .93 |
| Kroma Reds* | lb. | .14 | - | .15 |
| Lake Red C* | lb. | — | - | 1.13 |
| Mapico Reds* (50 lb. bags) | lb. | .13¾ | - | .14 |
| Mercadium X-2668 Light* | lb. | — | - | 1.95 |
| X-2669 Medium Light* | lb. | — | - | 2.10 |
| X-2670 Medium* | lb. | — | - | 2.25 |
| X-2671 Dark* | lb. | — | - | 2.48 |
| Oximony Red Iron Oxide | lb. | .12¼ | - | .13 |
| Plasticone Reds* | lb. | — | - | 4.60 |
| Polaris Red* | lb. | — | - | 1.65 |
| Recco Red Oxide* | lb. | .12 | - | .13 |
| Red Iron Oxide, Light | lb. | .13¼ | - | .14 |
| Red Powders | lb. | — | - | 4.40 |
| Rubber Dispersed Reds | lb. | 1.47 | - | 3.58 |
| Rubber Red FBD* (Disp.) | lb. | — | - | 1.90 |
| 2BD, Dispersed* | lb. | — | - | 1.80 |
| 2BL* | lb. | — | - | 1.24 |
| PBL* | lb. | — | - | 1.24 |
| Rubanox Reds* | lb. | 1.40 | - | 1.50 |
| Rubber Red CP-339* (dlvd.) | lb. | — | - | 1.10 |
| Rubber Red X-1148* | lb. | — | - | .93 |
| Solfast Red* | lb. | 1.40 | - | 1.50 |
| Stan-Tone MBS* | lb. | 1.20 | - | 3.53 |
| GPE* | lb. | 1.65 | - | 2.00 |
| PC* | lb. | 1.30 | - | 2.50 |
| PDS* | lb. | 1.40 | - | 1.55 |
| PVC* | lb. | 1.65 | - | 1.90 |
| Vansul Red M.B.* | lb. | 1.00 | - | 3.35 |
| Watchung Red* | lb. | 1.65 | - | 1.95 |

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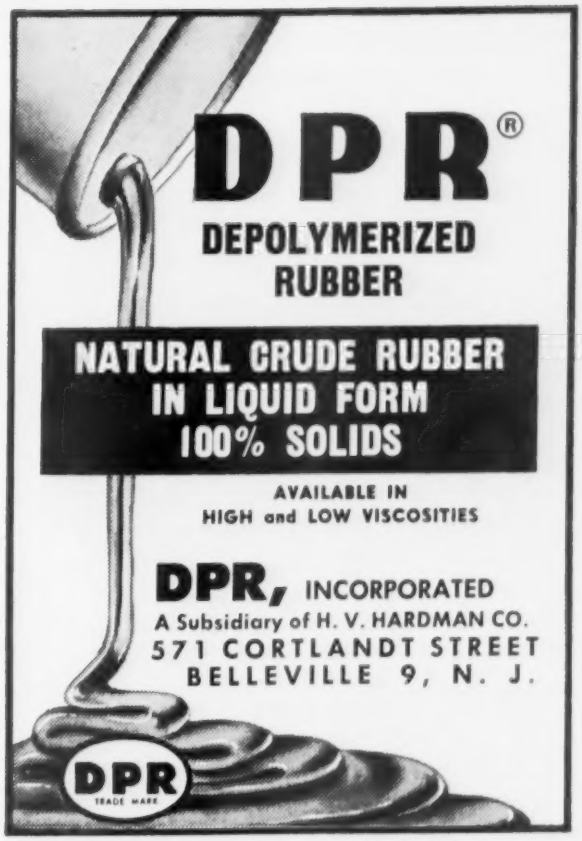




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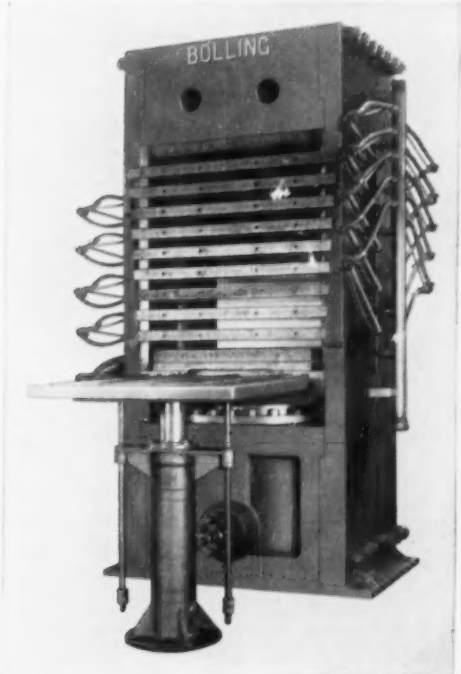


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## COLORING AGENTS (Cont'd)

### Tan

| | | | |
|---|---|---|---|
| Mapico Tan 15* (50 lb. bags) | lb. | .22¼ | .2300 |
| 20* (50 lb. bags) | lb. | .22¼ | .2300 |

### White—Lithopone

| | | | |
|---|---|---|---|
| Eagle-Picher* | lb. | .0800 | .0975 |
| Permolith* | lb. | .0800 | .0875 |
| Sunolith* | lb. | .0800 | .0875 |

### White—Titanium Pigments

| | | | |
|---|---|---|---|
| Horse Head Anatase Grades* | lb. | .25½ | .26½ |
| Rutile Grades* | lb. | .25½ | .26½ |
| Stan-Tone PC* | lb. | —— | .55 |
| Ti-Cal* | lb. | .09 | .09¼ |
| R-22*, R-25*, R-27*, R-30* | lb. | .09¼ | .09⅜ |
| R-60* | lb. | .09⅜ | .10⅛ |
| Ti-Pure* | lb. | .24½ | .27½ |
| Anatase Grades* | lb. | .25½ | .26½ |
| Rutile Grades* | lb. | .27½ | .28¼ |
| Titanox A*—all grades (dlvd.) | lb. | .24½ | .25½ |
| C-50* (dlvd.) | lb. | .13⅞ | .14⅜ |
| RA* (dlvd.) | lb. | .26½ | .27½ |
| RA-10* (dlvd.) | lb. | .26½ | .27½ |
| RA-NC* (dlvd.) | lb. | .26½ | .27½ |
| RC* (dlvd.) | lb. | .09¼ | .09¼ |
| RC-HT* (dlvd.) | lb. | .09 | .09¼ |
| Unitane O-110* | lb. | .25½ | .26½ |
| O-220* | lb. | .25½ | .26½ |
| O-310* | lb. | .25½ | .26½ |
| O-410* | lb. | .25½ | .26½ |
| OR-150* | lb. | .27½ | .28½ |
| OR-250* | lb. | .27½ | .28½ |
| OR-340* | lb. | .27½ | .28½ |
| OR-342* | lb. | .27½ | .28½ |
| OR-350* | lb. | .27½ | .28½ |
| OR-540* | lb. | .27½ | .28½ |
| OR-640* | lb. | .27½ | .28½ |
| Zopaque* | lb. | .24½ | .25½ |
| R* | lb. | .26½ | .27½ |

### White—Zinc Oxide (American Process)

| | | | |
|---|---|---|---|
| AZO-DOX 44, 45 | lb. | .1450 | .1550 |
| AZO-ZZZ 11* (22*, 33*, 44*, 55*) | lb. | .1450 | .1550 |
| Eagle-Picher AAA* | lb. | .1450 | .1550 |
| Horse Head Special* | lb. | .1450 | .1550 |
| XX* | lb. | .1450 | .1550 |
| Protox 166* | lb. | .1450 | .1550 |
| 167* | lb. | .1450 | .1550 |
| 267* (pelleted) | lb. | .1450 | .1550 |
| St. Joe Black Label* | lb. | .1450 | .1550 |
| Green Label* | lb. | .1450 | .1550 |
| Red Label* | lb. | .1450 | .1550 |
| Pelleted | lb. | .1450 | .1550 |

### White—Zinc Oxide (Dispersed)

| | | | |
|---|---|---|---|
| Dispersed Zinc Oxide | lb. | —— | .13 |

### White—Zinc Oxide (French Process)

| | | | |
|---|---|---|---|
| AZO-ZZZ 66 | lb. | .1450 | .1550 |
| Florence Green Seal* | lb. | .1625 | .1725 |
| Red Seal* | lb. | .1575 | .1675 |
| White Seal* | lb. | .1625 | .1725 |
| Kadox 25* | lb. | .1625 | .1725 |
| 15*, 17*, 72* & 515 | lb. | .1450 | .1550 |
| Protox 168* | lb. | .1450 | .1550 |
| 169* | lb. | .1450 | .1550 |
| 268* (pelleted) | lb. | .1450 | .1550 |
| U.S.P. (cartons) | lb. | .1775 | .1975 |
| XX-78* | lb. | .1450 | .1550 |

### White—Zinc Sulfide

| | | | |
|---|---|---|---|
| Cryptone ZS* | lb. | .2530 | .2630 |
| Lehigh 35%* | lb. | .1550 | .1650 |
| 50%* | lb. | .1585 | .1685 |

### Yellow

| | | | |
|---|---|---|---|
| Akron Masterbatch* | lb. | 1.12 | 2.18 |
| Toners* | lb. | 2.10 | 6.60 |
| Benzidene-Lightfast | lb. | 2.75 | 3.50 |
| Benzidine Yellow | lb. | 2.35 | 2.45 |
| Cadmolith Yellow (dms.) | lb. | 1.12 | 1.20 |
| Chrome Yellow | lb. | .32½ | .35 |
| Cooke M.B. Yellow 405* | lb. | 2.15 | 2.75 |
| 105* | lb. | —— | 2.15 |
| Iron Oxide, Pure Light Shades | lb. | .12 | .12¾ |
| Dark Shades | lb. | .11½ | .11¾ |
| Mapico Yellow* (50 lb. bags) | lb. | .12 | .12¼ |
| Rubber Dispersed Yellows | lb. | 1.27 | 2.13 |
| Rubber Yellow GD* (disp.) | lb. | —— | 2.25 |
| GL* | lb. | —— | 1.68 |
| Rubber Yellow X-1940* | lb. | —— | 2.35 |
| Stan-Tone Cadmium Dry* | lb. | 2.80 | 3.03 |
| Cadmium Paste* | lb. | 1.63 | 1.99 |
| MBS* | lb. | 1.30 | 2.20 |
| GPE* | lb. | 4.25 | 4.50 |
| PC* | lb. | .55 | 3.40 |
| Sumatra Yellow X-1940* | lb. | —— | 2.45 |
| Toluidine Yellow | lb. | 2.00 | 2.10 |
| YL-660 D* | lb. | 1.25 | 1.35 |
| Oximony Iron Oxide | lb. | .12¾ | .13 |
| Vansul Yellow M.B.* | lb. | 1.00 | 2.00 |
| Yellow Powders | lb. | 2.00 | 5.00 |
| Zinc Yellow | lb. | .27½ | .29 |

## DISPERSING AGENTS

| | | | |
|---|---|---|---|
| Anchoid*(†) | lb. | .24 | .25 |
| Anhydrapent* | lb. | .56 | .59 |
| Armeen 18* | lb. | .39 | .45 |
| Blancol* | lb. | —— | .15¼ |
| Darvan No. 1* (and No. 2*) | lb. | .22 | .30 |
| Daxad 11* (21*, 23*) | lb. | .08 | .30 |
| Diethanolamine (dms., dlvd.) | lb. | .24½ | .27½ |
| Dispersaid* | lb. | 1.25 | 1.35 |
| Emcol K-8300* (dms.) | lb. | .14 | .18 |
| P10-59 | lb. | .32 | —— |
| 3120 | lb. | .31 | —— |
| 3138 | lb. | .31 | —— |
| Emulphor ON-870* | lb. | —— | .55 |
| Furols* | lb. | .06½ | .07½ |
| Halloid* | lb. | .04½ | .05½ |
| Hyeryl A-1000* | lb. | .09 | .09½ |
| Igepal CO-630* | lb. | —— | .29 |
| Igepon T-73* | lb. | —— | .29½ |
| Kyro EO* (dms.) | lb. | —— | .29¾ |
| Leonil SA* | lb. | —— | .55 |
| Lomar PW* | lb. | —— | .18 |
| Marasperse C* | lb. | .06¼ | .06¾ |
| CB* | lb. | .13 | .15 |
| N* | lb. | .09½ | .10½ |
| Monoethanolamine (dms., dlvd.) | lb. | .25 | .28 |
| Naccotan A* | lb. | .16½ | .17 |
| Nekal BA-75* | lb. | —— | .40 |
| BX-78* | lb. | —— | .64 |
| Nopco 1187-X* | lb. | .15 | .16 |
| Pluronic F68* | lb. | .38½ | .44 |
| Polyfon* | lb. | .08 | .09 |
| R & R 551* | lb. | —— | .28 |
| Rubbex* | lb. | .247 | .277 |
| Stablex B* | lb. | .50 | .95 |
| Stan-Chem BQC* | lb. | .12¼ | .17¼ |
| 1067* | lb. | —— | .13½ |
| 1471* | lb. | .1687 | .2187 |
| 2251* | lb. | .12¼ | .17¼ |
| Trenamine D-25* | lb. | .32½ | .36 |
| Triethanolamine (dms., dlvd.) | lb. | .22 | .25 |
| Yelkin TT* (and TTS*) | lb. | .13 | .16 |

## EXTENDERS

| | | | |
|---|---|---|---|
| Areco 1071-13B* | lb. | .14½ | .15½ |
| 1073-18B* | lb. | .13½ | .14½ |
| 1294-36B* | lb. | .11½ | .12½ |
| Car-Bel-Ex-A* (and B*) | lb. | —— | .14 |
| Extender 600* | lb. | —— | .1765 |
| Facile Gum 4A* | lb. | .48 | .50 |
| Millex* | lb. | —— | .07 |
| W* | lb. | —— | .07 |
| Nopco 2271* | lb. | .15½ | .16½ |
| Polyco 418* | lb. | .17 | .18 |
| PR-162 Latex Extender* | lb. | —— | .182 |
| Solvitose HDF* | lb. | .22 | .25 |
| Synprolac* | lb. | .16 | .23 |
| Synprowax* | lb. | —— | .23 |
| Vistanex MM Grades* | lb. | —— | .35 |

## FILLERS (Inert and Reinforcing)

| | | | |
|---|---|---|---|
| Abrasives | | | |
| Carbonite* | lb. | .21½ | 1.35 |
| Lionite* | lb. | .16 | 1.27 |
| Pumice | lb. | .03 | .05 |
| Walnut Shell Grits | lb. | .05 | .08 |
| Aluminum Hydrate | lb. | .0850 | .1200 |
| Kaiser Alumina* | lb. | .026 | .059 |
| Aluminum Silicate | | | |
| AFD* | ton | 26.50 | 60.00 |
| Aluminum Flake* | ton | 23.50 | 32.50 |
| Marter White* | ton | 18.50 | 30.00 |
| Barium Carbonate (l.c.l.) | ton | 95.50 | 100.00 |
| Barytes | | | |
| No. 1 Floated, White* | ton | 45.00 | 65.10 |
| No. 2 Floated, Unbleached* | ton | 43.00 | 63.10 |
| No. 22 Barytes* (c.l.) | ton | —— | 30.00 |
| No. 3805 Barytes* | ton | 22.00 | 26.75 |
| Foam A* | ton | —— | 45.00 |
| Sparmite* | ton | 80.00 | 85.00 |
| XIOR* | ton | 80.00 | 85.00 |
| Bentonite (c.l.) | ton | —— | 13.50 |
| Argosite Clay* (c.l.) | ton | —— | 12.50 |
| Bennett Clay* (c.l.) | ton | —— | 32.50 |
| SPV Volclay* (c.l.) | ton | —— | 12.50 |
| White Hi-Gel* | ton | —— | 65.90 |
| Blanc Fixe | ton | 72.50 | 120.00 |
| Calcium Carbonate | | | |
| Atomite* (c.l.) | ton | —— | 32.50 |
| B.I. White No. 1 (c.l.) | ton | —— | 9.00 |
| Calcene NC* | ton | 72.50 | 92.50 |
| TM* | ton | 75.00 | 95.00 |
| Calwhite* | ton | —— | 20.00 |
| Camel-Carb* | ton | —— | 12.00 |
| Camel-Tex* | ton | —— | 20.00 |
| Camel-Wite* | ton | —— | 32.50 |
| Duramite* | ton | —— | 20.00 |
| Gamaco* (c.l.) | ton | —— | 32.50 |
| Georgia Marble 5-25* (c.l.) | ton | —— | 20.00 |
| No. 10 White* (c.l.) | ton | —— | 11.00 |
| Kalite* | ton | 50.00 | 65.00 |
| Laminar* | ton | —— | 30.00 |
| Lexamite* (c.l.) | ton | —— | 27.50 |
| Lorite* | ton | 30.00 | 36.00 |
| Millical* | ton | 38.00 | 53.00 |
| Multifex MM* | ton | 110.00 | 125.00 |
| Non-Fer-Al* | ton | 32.50 | 37.50 |
| Purecal M* | ton | 56.75 | 80.75 |
| SC* (and T*) | ton | 110.00 | 125.00 |
| U* | ton | 120.00 | 135.00 |

## FILLERS (Cont'd)

| | | | |
|---|---|---|---|
| Calcium Carbonate (cont'd) | | | |
| Rambo No. 1* | ton | —— | 16.50 |
| Snowflake* | ton | 17.00 | 20.00 |
| Super Multifex* | ton | 160.00 | 175.00 |
| Surfex* | ton | 37.50 | 52.50 |
| Suspenso* | ton | 35.50 | 50.50 |
| Witcarb Reg.* | ton | 56.75 | 85.00 |
| P* | ton | 110.00 | 140.00 |
| R* | ton | 120.00 | 150.00 |
| RC* | ton | 110.00 | 140.00 |
| York White* | ton | —— | 10.50 |
| Calcium Silicate Silene EF* | ton | 120.00 | 140.00 |
| Calcium Sulfate, Anhydrous Snow White Filler* | ton | —— | 21.00 |
| Calcium Sulfate Hydrous Terra Alba No. 1* | ton | —— | 17.00 |
| Chalk Whiting (l.c.l.) | lb. | .01½ | .01¾ |
| Recco Paris Whiting* | ton | —— | 35.00 |
| OMYA Whiting* | ton | —— | 30.00 |
| Clay | | | |
| Afton Clay* | ton | 12.00 | 35.50 |
| Aiken Clay* | ton | —— | 13.00 |
| Alsilite* (c.l.) | ton | 30.00 | 45.00 |
| Aluminum Flake* | ton | 23.50 | 30.00 |
| Buca* (c.l.) | ton | —— | 45.00 |
| Burgess No. 20* | ton | —— | 35.00 |
| No. 30* | ton | —— | 37.00 |
| Burgess Iceberg* | ton | —— | 50.00 |
| Catalpo* (c.l.) | ton | —— | 35.00 |
| Champion* | ton | —— | 14.00 |
| Crown* | ton | —— | 14.00 |
| Dixie* (c.l.) | ton | —— | 14.00 |
| Franklin Clay—R* (c.l.) | ton | 15.00 | 39.00 |
| G. K. Soft* | ton | 11.00 | 28.00 |
| Harwick Clays* | ton | 14.50 | 57.00 |
| Hi-White R* | ton | —— | 13.50 |
| Kaolloid Clay* (c.l.) | ton | —— | 10.50 |
| LGB* | ton | —— | 17.00 |
| LGP* | ton | —— | 19.00 |
| McNamee* (c.l.) | ton | —— | 13.50 |
| Natka 1200 (c.l.) | ton | —— | 12.00 |
| Par* (c.l.) | ton | —— | 12.00 |
| Paragon* | ton | —— | 13.50 |
| Pigment 5* | ton | 23.50 | 26.50 |
| 33* | ton | —— | 37.00 |
| Recco* (c.l.) | ton | —— | 14.00 |
| Swanee Clay* | ton | —— | 12.50 |
| Snobrite* | ton | —— | 12.50 |
| Suprex* | ton | —— | 14.00 |
| Whitetex* (c.l.) | ton | —— | 50.00 |
| 4200 Clay* | ton | —— | 11.00 |
| Diatomaceous Earth | ton | 30.00 | 50.00 |
| Kaylorite* (c.l.) | ton | —— | 30.00 |
| Lorite* | ton | —— | 30.00 |
| Flock | | | |
| Cotton (White) | lb. | .28 | .32 |
| Colored | lb. | .11 | .13½ |
| Filfloc F 40-9000* | lb. | —— | .13 |
| F 6000* | lb. | —— | .36 |
| Polycel* | ton | 110.00 | 210.00 |
| Rayon, Bleached or Dyed | lb. | .75 | 1.20 |
| Rayon, Grey | lb. | —— | .18 |
| Rayon, Pink | lb. | —— | .20 |
| Solka-Floc* (l.c.l.) | lb. | .07 | .16 |
| Glue, Amber | lb. | .17 | .19 |
| Ground Softwood Bark Silvacon* (c.l.) | ton | 55.00 | 100.00 |
| Leather | | | |
| Flour (dust) | lb. | .12 | .15 |
| Shredded | lb. | .05 | .17 |
| Lignin | lb. | .06 | .08 |
| Indulin* | lb. | .06 | .08 |
| Limestone, Pulverized | ton | 3.00 | 5.00 |
| Asbestol Regular* | ton | 27.00 | 29.00 |
| Asbestol Superfine* | ton | 32.00 | 34.00 |
| Georgia Marble No. 10* | ton | —— | 11.00 |
| Industrial Filler No. 100* | ton | —— | 5.75 |
| Micro Velva A* | ton | 49.00 | 51.00 |
| L* | ton | 57.00 | 59.00 |
| No. 1 White* | ton | —— | 10.00 |
| Magnesium Carbonate | lb. | .12½ | .15 |
| K & M Clearcarb* | lb. | —— | .14 |
| Technical* (c.l., eqld.) | lb. | .10½ | .12 |
| Marinco CL* | lb. | —— | .17 |
| Magnesium Silicate (see Talc) | | | |
| Mica | lb. | .01¼ | .07¼ |
| Concord* | lb. | .08 | .08¾ |
| Micro-Mica* | lb. | .08 | .08¾ |
| Mineralite* (c.l.) | ton | 40.00 | 85.00 |
| Silversheen* | lb. | .08 | .08¾ |
| Triple A Mica* (c.l.) | ton | —— | 30.00 |
| Vermiculite* | lb. | —— | .11 |
| Wet Ground Biotite Mica | lb. | .06½ | .07¼ |
| Wet Ground Mica No. 160* | lb. | .08 | .08¾ |
| Pecan Shell Flour Stan Shell* | ton | 45.00 | 75.00 |
| Pyrophyllite | | | |
| No. 261* | ton | —— | 11.50 |
| Pyrax A* (c.l.) | ton | —— | 13.50 |
| WA* (c.l.) | ton | —— | 16.00 |
| Sawdust, Graded | ton | 14.00 | 35.00 |
| Silica | ton | 16.00 | 27.00 |
| Extra Fine (bags) (c.l.) | ton | —— | 43.00 |
| Slate, Powdered (l.c.l.) | ton | 15.00 | 20.00 |
| Lo-Micron Slate Flour* | lb. | —— | .04½ |
| No. 133 Slate Flour* | ton | —— | 4.55 |
| Sodium Silico Aluminate Zeolex 23* | ton | 120.00 | 140.00 |

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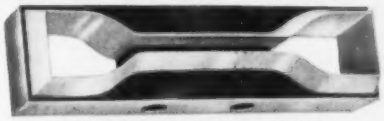

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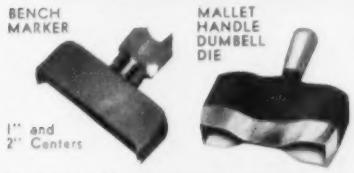


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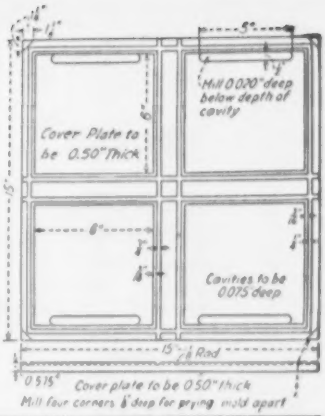
Mill 0.020" deep below depth of cavity
Cover Plate to be 0.50" Thick
Cavities to be 0.075 deep
0.515"
Cover plate to be 0.50" thick
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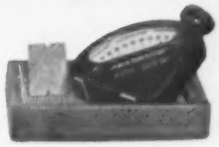

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| Asbestol Regular* | ton | — | 27.00 |
| Eastern RC-500* | ton | — | 32.00 |
| No. 41* | ton | — | 19.70 |
| No. 549* | ton | — | 63.00 |
| French* | ton | — | 59.00 |
| L.S. Silver* | ton | 33.75 | 38.75 |
| No. 367* | ton | — | 13.00 |
| No. 1600* | ton | — | 70.60 |
| No. 1768* | ton | — | 13.00 |
| Nytal 200* (c.l.) | ton | — | 28.00 |
| 300* (c.l.) | ton | — | 38.00 |
| Sierra Fibrene C-400* | ton | 33.00 | 38.00 |
| Supreme 325* | ton | 46.25 | 57.25 |
| Sierra White* | ton | 20.75 | 31.75 |
| Soapstone* | ton | — | 13.00 |
| Walnut Shell Flour | ton | 55.00 | 100.00 |
| Stan-Shell* | ton | 50.00 | 84.00 |
| Whiting, Commercial | ton | — | 7.50 |
| Allied Whiting* | ton | 10.50 | 21.50 |
| Camel-Carb* | ton | — | 10.00 |
| Calwhite (c.l.) | ton | — | 20.00 |
| C-C-O White* | ton | 20.00 | 22.50 |
| Georgia Marble No. 15* | ton | — | 20.00 |
| No. 16* | ton | — | 20.00 |
| Pigna No. 1 YAA* (c.l.) | ton | 1.00 | 10.00 |
| No. 2 LS* (c.l.) | ton | 1.00 | 10.00 |
| Snowflake* (c.l.) | ton | — | 20.00 |
| Stan-White 325* | ton | 11.50 | 14.10 |
| Veroc* (c.l.) | ton | — | 10.50 |
| Welco* (c.l.) | ton | — | 10.50 |
| York White R* (c.l.) | ton | — | 10.00 |
| Wood Flour | ton | 31.50 | 48.00 |

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|---|---|---|---|
| Beaco Finishes* | gal. | 2.10 | 2.35 |
| Black Out* | gal. | 4.50 | 8.00 |
| Shellac, Orange Gum | lb. | .50 | .60 |
| VanWax* | gal. | 1.45 | 1.50 |

### FLAME RETARDANTS

| | | | |
|---|---|---|---|
| Cellulflex CEF* (dms.) | lb. | — | .65 |
| Chlorowax 40* | lb. | .15¼ | .17¼ |
| 50* | lb. | .16¾ | .17¾ |
| 70* | lb. | .18½ | .20 |
| Halowax* | lb. | .36 | .46 |
| Zinc Borate 3167* | lb. | .1920 | .2020 |
| Zyrox Compounds* | lb. | .38 | .95½ |

### LATEX MODIFIERS

| | | | |
|---|---|---|---|
| Ludox | lb. | .15 | .16¼ |
| OPD-101* | lb. | — | .28 |
| Piccopale A-1 Emulsion | lb. | .086 | .107 |
| Ubatol U-2001* (dms.) | gal. | 1.84 | 1.87 |

### LUBRICANTS, MOLD

| | | | |
|---|---|---|---|
| Akro Gel* | lb. | — | .165 |
| Alipal CO-433* | lb. | — | .20 |
| CO-436* | lb. | — | .24 |
| Aluminum Stearate Crown Brand* | lb. | .37 | .42 |
| Amine, Mixed Crude* | lb. | .19 | .25 |
| Aquadag* | lb. | 3.50 | 4.00 |
| Aquarex D* | lb. | — | .78 |
| L* | lb. | — | .94 |
| ME* | lb. | — | .80 |
| MDL* | lb. | — | .33 |
| WAQ* | lb. | — | .22 |
| Armeen HT* | lb. | .34 | .40 |
| 180* | lb. | .52 | .56 |
| Armid HT (flaked)* | lb. | .42 | .46 |
| 0* | lb. | .39 | .41 |
| Borax, Granular (l.c.l.) | ton | 89.00 | 94.00 |
| Carbowax 4000* | lb. | .31 | .32 |
| CD Mold Release B* | gal. | 5.00 | — |
| B-2* | gal. | 5.00 | — |
| Colite Concentrate* (dms.) | gal. | .90 | 1.15 |
| Colite D43D* | gal. | 1.15 | 1.40 |
| Concentrex* | lb. | — | .25 |
| Dag Dispersions No. 197* | lb. | 1.85 | 2.90 |
| D.C. 7 Compound* | lb. | 5.13 | 6.50 |
| D.C. Emulsion No. 7* | lb. | 1.59 | 2.07 |
| No. 8* | lb. | 1.22 | 1.76 |
| No. 35* | lb. | 1.22 | 1.76 |
| No. 35A* | lb. | 1.22 | 1.76 |
| No. 35B* | lb. | 1.22 | 1.76 |
| No. 36* | lb. | 1.22 | 1.76 |
| D.C. Mold Release Fluid* | lb. | 3.14 | 4.75 |
| Dri-Lube* | lb. | — | .22 |
| Emulsion Lubricant A80* | lb. | — | 1.80 |
| 45* | lb. | — | 1.80 |
| G-E Silicone Emulsion SM-55* | lb. | 1.22 | 1.76 |
| SM-61* | lb. | 1.22 | 1.76 |
| SM-62* | lb. | 1.22 | 1.76 |
| G-E Silicone Fluid SF-93* | lb. | 3.14 | 4.25 |
| SF-96* | lb. | 3.14 | 4.25 |
| Glydag G* | lb. | 1.30 | 2.45 |
| Hawkeye Flake* (dlvd.) | lb. | .15 | .15¼ |
| HSC No. 35* | lb. | 1.22 | 2.46 |
| No. 515 | lb. | 1.22 | 2.46 |
| Igepal CO-430* | lb. | — | .29 |
| CO-630* | lb. | — | .29 |
| CO-530* | lb. | — | .29 |
| Igepon AP-78* | lb. | — | .48 |
| T-33* | lb. | — | .21 |
| T-51* | lb. | — | .13½ |
| Kokobace R* | lb. | .17½ | .18½ |
| Lubrex | lb. | .25 | .30 |
| Lubri-Flo* | gal. | 10.00 | 12.00 |

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|---|---|---|---|
| Migralube* | lb. | — | .35 |
| ML-1027-2C* | gal. | — | 2.15 |
| ML-1028-2C* | gal. | — | 2.15 |
| Mold Lubricant No. 72 Conc.* (dms.) | gal. | — | 1.90 |
| No. 735* (dms.) | gal. | — | 1.25 |
| No. 769* (dms.) | gal. | — | 1.20 |
| No. 825* (dms.) | gal. | — | 2.00 |
| No. 856* (dms.) | gal. | — | 1.90 |
| No. 880* (dms.) | gal. | — | 1.19 |
| No. 887* (dms.) | gal. | — | 1.80 |
| No. 896* (dms.) | gal. | — | 1.28 |
| No. 935* (dms.) | gal. | — | 1.56 |
| No. 956* (dms.) | gal. | — | 2.50 |
| No. 965* (dms.) | gal. | — | 2.15 |
| No. 967* (dms.) | gal. | — | 2.40 |
| No. 969* (dms.) | gal. | — | 1.50 |
| No. 975* (dms.) | gal. | — | 2.85 |
| No. 980* (dms.) | gal. | — | 1.53 |
| No. 987* (dms.) | gal. | — | 2.45 |
| Moldeze No. 3* | gal. | — | 4.95 |
| Mold-Brite* | gal. | — | 1.50 |
| Monopole Oil MD* | lb. | — | .16 |
| Olate Flakes* | lb. | .22 | .23 |
| Orvus WA Paste* (dms.) | lb. | — | .22 |
| Plaskon Polyethylene S* | lb. | .32 | .47 |
| Poly-Brite PE-20 | lb. | .28 | .42 |
| 600 | lb. | .42 | .58 |
| Poly-Cone 125X | lb. | 1.22 | 1.40 |
| 1,000 | lb. | .94 | 1.06 |
| Polyglycol 15-200* | lb. | .25 | .28¼ |
| E4000* | lb. | .31 | .37 |
| Prodag* | lb. | .28 | .42 |
| Purity Flake* (dlvd.) | lb. | .18 | .19¼ |
| Rubber-Flo* | gal. | 1.25 | 2.00 |
| Rubber-Glo* | gal. | — | .94 |
| Rusco Mold Paste* | lb. | — | .25 |
| Sericite* (l.c.l.) | ton | 65.00 | 75.00 |
| Silicone Oil A145* | lb. | 3.18 | 3.61 |
| Silrex (dms.) | lb. | — | .65 |
| A65* | lb. | 2.50 | 2.75 |
| Soybean Lecithin | lb. | .13 | .17 |
| Thermalube* | lb. | — | .13¾ |
| UC Silicone L-45* | lb. | 3.14 | 4.75 |
| L-522* | lb. | 3.05 | 4.05 |
| LE-45* | lb. | 1.22 | 1.70 |
| LE-450* | lb. | 1.22 | 1.70 |
| Ucon Lubricants* | lb. | .26½ | .27¾ |
| Ulco Mold Soap* | lb. | .15 | .29 |

### LUBRICANTS, RUBBER

| | | | |
|---|---|---|---|
| Diglycol Stearate Neutral (and SE) (dms.) | lb. | — | .25 |
| Extrud-o-Lube* | gal. | 1.33 | 1.54 |
| G.B. Naphthenic Neutrals* | gal. | .11 | .18 |
| Ivory Chips* | lb. | .18½ | .19¼ |
| Latex-Lube GR* (dlvd.) | lb. | .19¼ | .20 |
| No. 82-A* (450 lb. dms.) | lb. | — | .08½ |
| Propylene Stearate (dms.) | lb. | .35 | .60 |

### LUBRICANTS, RUBBER SURFACE

| | | | |
|---|---|---|---|
| Bariura Stearate | lb. | .41 | .46 |
| Calcium Stearate | lb. | .39 | .44 |
| Crown Brand* | lb. | .37 | .42 |
| D.C. 7 Compound* | lb. | 5.13 | 6.50 |
| D.C. 200 Fluid* | lb. | 3.14 | 4.75 |
| ELA* | lb. | — | .82 |
| G-E Silicone Fluid SF-92* | lb. | 3.14 | 4.25 |
| Glycerized Lubricant* | gal. | 1.25 | 1.48 |
| Glydag B* | lb. | 1.50 | 2.10 |
| G* | lb. | 1.30 | 2.45 |
| Glyso-Lube* (dms.) | lb. | — | .14 |
| No. 3* (dms.) | lb. | — | .14 |
| HSC No. 35* | lb. | 1.28 | 1.34 |
| No. 515* | lb. | 1.28 | 1.34 |
| Hydro-Zinc* | lb. | — | .20 |
| Latex-Lube Pigmented* (dlvd.) | lb. | .17¼ | .18¼ |
| R-66* | lb. | — | .16½ |
| Liqui-Lube* (dlvd.) | lb. | — | .16¼ |
| N.F.* (dlvd.) | lb. | — | .16¼ |
| N.T.* (dlvd.) | lb. | — | .16¼ |
| Lubrex* | lb. | .25 | .30 |
| Lubri-Cote | gal. | .86 | 1.00 |
| Magnesium Stearate Crown Brand* | lb. | .40 | .45 |
| Polyethylene Glycol | lb. | .22 | .26 |
| Rubber Free (Concentrate)* | gal. | — | 1.44 |
| Jel* | lb. | .18 | .21½ |
| Slab-Dip* (dms.) | lb. | — | .15 |
| Soybean Lecithin | lb. | .13 | .17 |
| Stock-Lube* | lb. | — | .19 |
| UC Silicone L-45* | lb. | 3.14 | 4.75 |
| L-522* | lb. | 3.05 | 4.05 |
| LE-450* | lb. | 1.22 | 1.70 |
| Zinc Stearate | lb. | .41 | .46 |

### MOLD CLEANERS

| | | | |
|---|---|---|---|
| Actusol* (dlvd.) | gal. | 1.45 | 1.65 |
| Alkon* (dlvd.) | lb. | .16 | .16½ |
| CA-301* | gal. | — | 2.49 |
| CA-302* | gal. | — | 2.63 |
| G-O 6910* | lb. | .38 | .40 |
| Metso Anhydrous* | cwt. | 5.70 | 7.95 |
| Metso 99* | cwt. | 5.00 | 7.25 |
| 200* | cwt. | 6.70 | 8.95 |
| Granular* | cwt. | 4.45 | 6.70 |
| Orvus Extra Granules* | lb. | .22½ | .23½ |
| Rubber-Sol* | gal. | 2.97 | 3.97 |
| Sprex A.C.* (dlvd.) | lb. | .17¼ | .18¾ |
| Zip Mold Cleaner* | gal. | .95 | 1.45 |

### PEPTIZING AGENTS

| | | | |
|---|---|---|---|
| Peptizer P-12* | lb. | .95 | 1.25 |
| Pepton 22 Plasticizer* | lb. | .81 | .84 |
| 65* | lb. | 1.20 | 1.23 |
| 65B* | lb. | .81 | .84 |
| RPA 2* | lb. | — | .82 |
| 3* | lb. | — | .48 |
| 3 Conc.* | lb. | — | .85 |
| 5* | lb. | — | .68 |
| 6* | lb. | — | 1.62 |

### PLASTICIZERS & SOFTENERS

| | | | |
|---|---|---|---|
| Acto 500* | lb. | — | .09 |
| Adipol BCA* | lb. | .45 | .45½ |
| 2EH* | lb. | .42½ | .43½ |
| 10A* | lb. | .42½ | .43½ |
| ODY* | lb. | .47½ | .48½ |
| R10* | lb. | .42½ | .45½ |
| XX* | lb. | .42½ | .43½ |
| Anhydrol 6990* | lb. | .51 | .56 |
| Arneel SD* | lb. | .34 | .40 |
| Arolene 1980* (c.l.) | lb. | — | .10 |
| Aromatic Plasticizer 10* (and 25*) (dms.) | lb. | .05 | .06½ |
| Aromatic Tar | gal. | .0573 | .1973 |
| Bardol* | lb. | .02¾ | .03¾ |
| B* | lb. | .06¼ | .06½ |
| Bayol D* | gal. | — | .382 |
| F* | gal. | — | .52 |
| Beeswax, Bleached | lb. | .76 | .79 |
| Yellow Refined | lb. | .68 | .70 |
| Bondogen* | lb. | .55½ | .60½ |
| B.R.C. No. 20* | lb. | .0150 | .0175 |
| No. 21* | lb. | .02¼ | .03 |
| No. 22* | lb. | .02¼ | .02¾ |
| B.R.H. 2* | lb. | .0213 | .0351 |
| BRS 700* | lb. | .0200 | .0285 |
| B.K.T. 3* | lb. | .0180 | .0265 |
| 4* | lb. | .0250 | .0260 |
| 7* | lb. | .0300 | .0310 |
| B.R.V.* | lb. | .0475 | .0565 |
| Bunarex Resins* | lb. | .07 | .08 |
| Bunatak AH* | lb. | — | .09½ |
| N* | lb. | — | .31 |
| U* | lb. | — | .17½ |
| No. 90* | lb. | — | .09 |
| No. 210* | lb. | — | .14 |
| Butac* | lb. | .12½ | .13¼ |
| Butyl Carbitol Periargonate (dms.) | lb. | — | .64½ |
| Butyl Cellosolve Periargonate (dms.) | lb. | — | .68 |
| Butyl Oleate | lb. | .25¼ | .26½ |
| Butyl Palmitate | lb. | — | .26½ |
| Butyl Stearate (dms.) | lb. | .24½ | .25½ |
| BWH-1* | lb. | .16 | .17 |
| Cabflex DDA* | lb. | .40 | .43½ |
| DDP* | lb. | .29½ | .33 |
| Di-BA* | lb. | .41 | .44½ |
| Di-OA* | lb. | .40 | .43½ |
| Di-OP* | lb. | .28½ | .32 |
| Di-OZ* | lb. | .45½ | .49 |
| DOA* | lb. | .40 | .43½ |
| DOP* | lb. | .28½ | .32 |
| HS-10 | lb. | .44 | .47½ |
| ODA* | lb. | .40 | .43½ |
| ODP* | lb. | .29 | .32½ |
| TCP* | lb. | .34½ | .38 |
| Calflux 510* (and 550*) | lb. | .03½ | .03¾ |
| G.P.* | lb. | .02¼ | .02½ |
| R-100* | lb. | .05½ | .05¾ |
| TT* | lb. | .0270 | .0295 |
| Candelilla Wax, Prime | lb. | .70 | .74 |
| Refined Light | lb. | .73 | .78 |
| Carbowax 4000* (dms.) | lb. | .31 | .32 |
| Carnauba Wax, Crude | lb. | .71 | .77 |
| Flaked | lb. | .72 | 1.55 |
| Refined, Technical | lb. | .72 | .80 |
| Refined, Pure | lb. | .80 | .86 |
| Yellow | lb. | 1.42 | 1.45 |
| Celluflex* (dms.) 112* (t.c., dlvd.) | lb. | — | .34½ |
| 179-A* (t.c., dlvd.) | lb. | — | .32½ |
| 179-C* (t.c., dlvd.) | lb. | — | .32½ |
| 179-EG* (t.c., dlvd.) | lb. | — | .32½ |
| DBP* (t.c., dlvd.) | lb. | — | .30 |
| DOP* (t.c., dlvd.) | lb. | — | .28½ |
| TPP* (dms., eqld.) | lb. | — | .40 |
| Ceresin Wax | lb. | .12 | .30 |
| Chlorowax 40* | lb. | .15¼ | .17¼ |
| 50* | lb. | .16¾ | .17¾ |
| 70* | lb. | .18½ | .20 |
| LV* | lb. | .17¼ | .19¼ |
| CTLA Polymer* | gal. | .20 | .36 |
| Cumar Resins* | lb. | .07 | .19 |
| Darex DBP* | lb. | .30 | .33 |
| DOP* | lb. | .30½ | .33½ |
| DIOP* | lb. | .30½ | .33½ |
| D.B.M.* | lb. | .32 | .34¼ |
| Decylbutyl Phthalate | lb. | .27 | .29½ |
| Degras, Common | lb. | — | .14 |
| Diallyl Phthalate | lb. | .51½ | .52½ |
| Dibenzyl Sebacate | lb. | .88 | .89½ |
| Dibutoxyethyl Sebacate | lb. | — | .56¾ |
| Dibutyl Phthalate | lb. | .30 | .33½ |
| Dibutyl Sebacate | lb. | .64½ | .66 |
| Dicapryl Adipate | lb. | .42 | .44 |
| Dicapryl Phthalate | lb. | .29½ | .31 |
| Dicapryl Sebacate | lb. | .58 | .59½ |
| Di-Carbitol Phthalate (dms.) | lb. | .47 | .47½ |
| Dicyclohexyl Phthalate | lb. | .58¼ | .59¼ |
| Diethyl Phthalate (t.c.) | lb. | .25 | .27¼ |
| Di-2-ethylhexyl Phthalate | lb. | — | .30½ |
| Dihexyl Adipate | lb. | .40 | .42½ |
| Dihexyl Phthalate | lb. | .30 | .32½ |

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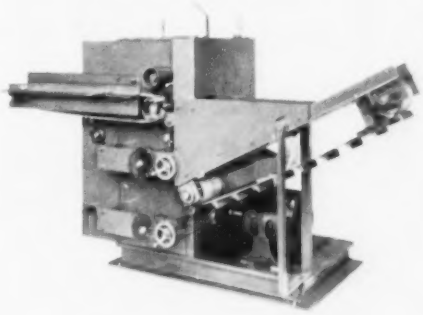

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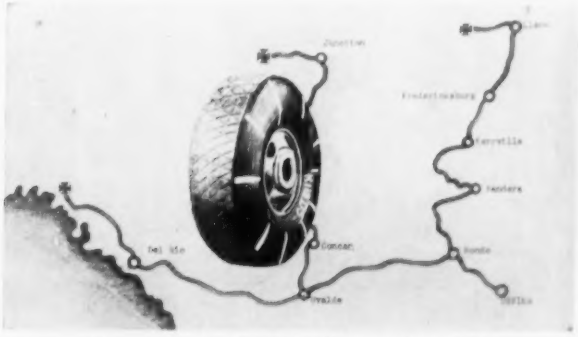

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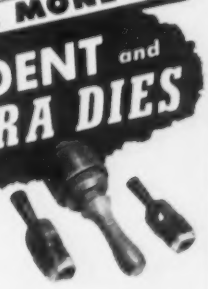

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## PLASTICIZERS & SOFTENERS (Cont'd)

| | | | |
|---|---|---|---|
| Dihexyl Sebacate | lb. | .65 | .74 |
| **Diisobutyl Azelate** | lb. | —— | **.47½** |
| Di-iso-octyl Adipate | lb. | .40 | .42½ |
| Di-iso-octyl Phthalate (t.c.) | lb. | .28 | .37½ |
| **Dimethyl Phthalate (t.c.)** | lb. | .27½ | **.30¼** |
| Dimethyl Sebacate | lb. | 1.30 | 1.39 |
| Dinonyl Adipate | lb. | **.44½** | **.47½** |
| Dinopol 235* | lb. | .38 | .39 |
| IDO* | lb. | .31 | .32 |
| MOP* | lb. | .35 | .36 |
| Dioctyl Adipate | lb. | .40 | .42½ |
| Dioctyl Phthalate (dms.) | lb. | .30½ | .31½ |
| Dioctyl Sebacate (dms.) | lb. | .58½ | .60 |
| D.I.O.P. (dms.) | lb. | .31 | .32 |
| **Dipolymer Oil** | gal. | .33 | .48 |
| **Dispersing Oil No. 10*** | lb. | .06 | **.06¼** |
| **Dutrex 6*** | gal. | —— | .11 |
| **15E*** | gal. | —— | .10 |
| **Elastex 10-P*** | lb. | **.30½** | **.33½** |
| **50-B*** | lb. | **.25** | **.28** |
| **DCHP*** | lb. | .59 | .60 |
| **Emulphor EL-719*** | lb. | —— | .58 |
| **Epoxy Plasticizer** | lb. | .33½ | .36 |
| Drapex 3.2* | lb. | .39¼ | .44 |
| Drapex 4.4* | lb. | .37 | .42 |
| Esparto Wax | lb. | —— | .55 |
| **Estac*** | lb. | —— | .16 |
| Facile Gum 4A* | lb. | .48 | .50 |
| Flexol B-400* | lb. | .27½ | .28½ |
| DOP* | lb. | .33 | .34 |
| TOF* | lb. | .45¼ | .46¼ |
| 3GH* | lb. | .46 | .46¾ |
| 3GO* | lb. | .55 | .55¾ |
| 4GO* | lb. | .35 | .36 |
| 426* | lb. | .29¼ | .30¼ |
| **Flexricin P-1*** | lb. | —— | .32 |
| P-4* | lb. | —— | .34¾ |
| P-6* | lb. | —— | .41½ |
| P-8* | lb. | —— | .34¾ |
| Fortex A* (dms.) | lb. | .12½ | .14½ |
| **Galex W-100*** | lb. | .15½ | **.19¼** |
| G.B. Asphaltic Flux* | gal. | .21 | .25 |
| G.B. Light Process Oil* | lb. | .0157 | .0177 |
| G.B. Medium Process Oil* | lb. | .03½ | .03¾ |
| G.B. Naphthenic Neutrals* | lb. | .04½ | .04¾ |
| Good-rite GP233* | lb. | .40 | .43½ |
| GP235* | lb. | .40 | .43½ |
| GP236* | lb. | .40 | .43½ |
| GP261* | lb. | .28 | .31½ |
| GP265* | lb. | .28½ | .32 |
| GP266* | lb. | .29 | .32½ |
| GP-266-BPA* | lb. | .29 | .32½ |
| Harflex 500* (dms.) | lb. | .31½ | .34 |
| HB20* | lb. | .15 | .17 |
| HB40* | lb. | .19 | .22 |
| **Herron-H.T.*** | gal. | .16 | .27 |
| **Herron-Plas*** | lb. | —— | **.03¾** |
| **Herron-Wax*** | lb. | .05¼ | .06 |
| **No. 23*** | lb. | **.08¼** | **.08¾** |
| **No. 24*** | lb. | .07¼ | **.07¾** |
| HSC No. 13* | lb. | .25 | .32 |
| No. 28 and 38* | lb. | .20 | .27 |
| **Indonex 632½* (633¾*, 634½*, 637½*)** | gal. | .12 | .19 |
| Isooctyl Decyl Phthalate | lb. | .28½ | .38 |
| Kapsol* | lb. | .35 | .35½ |
| **Kenflex*** | lb. | .18 | .27 |
| Kesscoflex 101* (dms.) | lb. | —— | .37½ |
| 103* (dms.) | lb. | —— | .38 |
| MCO* (dms.) | lb. | —— | .35½ |
| BCL* (dms.) | lb. | —— | .37½ |
| MCP* (dms.) | lb. | —— | .41 |
| BCP* (dms.) | lb. | —— | .36 |
| KP 23* | lb. | .31½ | .32½ |
| 90* | lb. | .42¼ | .43½ |
| 140* | lb. | .48 | .48½ |
| 201* | lb. | .58 | .59 |
| 220* | lb. | .34½ | .35½ |
| 555* | lb. | .56½ | .57 |
| **Kremol 40*** | gal. | .36 | .46 |
| **50*** | gal. | .39 | .49 |
| Kronisol* (dms.) | lb. | .33 | .36 |
| Kronitex AA* (dms.) | lb. | .35 | .36 |
| I* (dms.) | lb. | .35 | .36 |
| K-3* | lb. | .35 | .36 |
| MX* | lb. | .35 | .36 |
| Lanolin, Tech. Anhydrous | lb. | —— | .26 |
| Latex-Lube G.R.* | lb. | .19¼ | .20 |
| Lead Oleate | lb. | —— | .29¾ |
| Lindol* (dms., t.c.) | lb. | —— | .32½ |
| Locusol No. 1-6980* | lb. | .30 | .34 |
| **2-Mercaptoethanol (dms.)** | lb. | **1.25** | **1.50** |
| Methox* | lb. | .40½ | .41 |
| **Methyl Laurate** | lb. | .25 | .27 |
| **Methyl Oleate** | lb. | —— | .20 |
| **Methyl Stearate (dms.)** | lb. | —— | .30 |
| Monoplex DOS* | lb. | .59½ | .60½ |
| DBS* | lb. | .65½ | .66½ |
| S-70* | lb. | .41 | .42 |
| S-71* | lb. | .46½ | .47½ |
| Montan Wax, Crude | lb. | .26 | .35 |
| Flaked | lb. | .29 | .40 |
| **Morflex*** | lb. | **.32** | **.69½** |
| **MR 2088* (dms.)** | lb. | —— | .19 |
| Natac* | lb. | .12 | .13 |
| Nebony Resins* (dms.) | lb. | .04½ | .05 |
| **Neolene 210* (t.c.)** | lb. | —— | .16 |
| **212* (t.c.)** | lb. | —— | .14 |
| **220* (t.c.)** | lb. | —— | .15 |
| **Nerium*** | lb. | —— | .09 |
| **Nevillac kesina* (dms.)** | lb. | .31 | .85 |
| Neville LX-880* (dms.) | lb. | .12 | .13½ |
| LX-685* (dms.) | lb. | .12½ | .17½ |
| **Neville Resins* (dms.)** | lb. | .07¼ | .20 |
| Nevindene Resins* (dms.) | lb. | .16½ | .20 |
| Nevinol* (dms.) | lb. | —— | .24 |

## PLASTICIZERS & SOFTENERS (Cont'd)

| | | | |
|---|---|---|---|
| Nuba 1* (and 2*) (dms.) | lb. | .06¼ | .06¾ |
| **No. 480 Oil Proof Resin*** | lb. | —— | .18 |
| Ohopex Q10* (dms.) | lb. | .32 | .33 |
| R9* (dms.) | lb. | .37¼ | .37½ |
| **Ortho-Nitrobiphenyl** | lb. | .13 | .15 |
| Ozokerite Wax, White and Yellow | lb. | .24 | .31 |
| Paradene Resins (dms.) | lb. | .07¼ | .08 |
| No. 2 Flaked | lb. | .08 | .08½ |
| **Para Flux* (dms.)** | gal. | **.19¼** | **.20¼** |
| **2016* (dms.)** | gal. | **.22** | **.23** |
| **Para Lube* (t.c.l.)** | lb. | **.046** | **.048** |
| Paraplex G-25* | lb. | .76 | .77 |
| G-40* | lb. | .50 | .51 |
| G-50* | lb. | .40¾ | .41¾ |
| G-53* | lb. | .45 | .46 |
| G-60* (and G-61*) | lb. | .35 | .36 |
| G-62* | lb. | .37 | .38 |
| **Parmo*** | lb. | .06 | .13½ |
| Pepton 22 Plasticizer* | lb. | .81 | .84 |
| **PG-16*** | lb. | —— | .35 |
| **Philrich-5* (t.c.)** | gal. | —— | .11 |
| Picco 10* (and 25*) | lb. | .15 | .17 |
| 60* (and 75*) | lb. | .15 | .17 |
| 100* | lb. | .15 | .17 |
| **Piccocizer 30*** | lb. | .05½ | .07 |
| Piccolastic A* (B*, C*, D* & E*) | lb. | .28 | .29 |
| FT* (FHF* & FX*) | lb. | .1815 | .1965 |
| T-135* | lb. | .22¾ | .23¼ |
| Piccolyte S Resins* | lb. | .20½ | .22¾ |
| Piccopale Resins* | lb. | .12 | .13 |
| Piccoumaron Resins* | lb. | .07 | .24½ |
| **Pigmentar*** | lb. | .0460 | .0745 |
| **Pigmentaroil*** | lb. | .0460 | .0745 |
| **Plastac M*** | lb. | —— | .09¼ |
| **Plasticizer 2286*** | lb. | —— | .26¼ |
| **Plasticizer 4141*** | lb. | .56¾ | .66¾ |
| Plasticizer DP-200, DP-250, DP-520* | lb. | .42¼ | .46¼ |
| Plasticizer LP* | lb. | —— | .07 |
| Plasticizer MP* | lb. | —— | .08 |
| Plasticizer MT-511* | lb. | —— | .68¾ |
| Plasticizer ODN* | lb. | .35 | .41 |
| Plasticizer SC* | lb. | .42½ | .43½ |
| **Plasticizer W-13*** | lb. | .37 | **.38¾** |
| **Plastoflex 3*** | lb. | —— | .52 |
| 52* | lb. | .37¾ | .38¾ |
| **VS*** | lb. | **.41¾** | **.42¾** |
| Plastogen* | lb. | .08¼ | .09 |
| Plastolein 9050* (c.l.) | lb. | .54½ | .56½ |
| 9055* | lb. | .30½ | .32½ |
| 9058* | lb. | .48 | .50 |
| 9250* | lb. | .38¼ | .40¼ |
| 9715* | lb. | .39 | .40 |
| Plastone | lb. | .23 | .27 |
| Polycizer 162* | lb. | .28 | .31½ |
| 332* | lb. | .40 | .42½ |
| 562* | lb. | .28½ | .32 |
| 662* | lb. | .29 | .32½ |
| 532 and 632* | lb. | .40 | .42½ |
| ED* | lb. | —— | .51 |
| **Polyco 438*** | lb. | **.34** | .35 |
| Polymel C-130* | lb. | .13¼ | .14¾ |
| D* | lb. | .22½ | .23½ |
| **6*** | lb. | .05¼ | **.07¾** |
| Poly-Sperse AP-2 | lb. | .23 | .29½ |
| AP-300, LC-20 | lb. | .26 | .32½ |
| **Process Oil C-255* (c.l.)** | gal. | —— | .22 |
| **Propylene Stearate (dms.)** | lb. | —— | .32 |
| **PRR 1*** | gal. | .15 | .35 |
| **PT 67 Light Pine Oil* (dms.)** | gal. | —— | .60 |
| 101 Pine Tar Oil* (t.c., dms.) | gal. | .0460 | .0634 |
| 400 Pine Tar* (600* & 800*) (t.c., dms.) | lb. | .0460 | .0634 |
| PX-104* | lb. | .30 | .32½ |
| PX-108* | lb. | .30½ | .33 |
| **PX-138*** | lb. | **.32½** | **.33½** |
| **PX-208*** | lb. | **.44½** | **.45½** |
| **PX-238*** | lb. | **.44½** | **.45½** |
| PX-404* | lb. | .66 | .67 |
| PX-438* | lb. | .60 | .61 |
| PX-800* | lb. | .34 | .35 |
| PX-917* | lb. | .36½ | .37½ |
| Reogen* | lb. | .14½ | .14½ |
| 465 Resin* (dms.) | lb. | .07½ | .08 |
| **Resin C*** | lb. | .0225 | .0310 |
| Resimer* | lb. | .03¼ | .04¾ |
| L-4* | lb. | .02¾ | .03¾ |
| **Rexflex*** | lb. | —— | .15 |
| Rosin Oil | gal. | .80 | 1.35 |
| RR 10 (Neoprene)* | lb. | —— | .37 |
| **R.S.O. Softening Oil*** | lb. | .03 | .05 |
| RuBars* | lb. | .19¼ | .20 |
| Rubberol* | lb. | .18 | .25¾ |
| **Santicizer B-16*** | lb. | **.48¾** | **.49¾** |
| **E-15*** | lb. | **.52¾** | **.53¾** |
| **M-17*** | lb. | **.44¾** | **.45¾** |
| No. 140* | lb. | .32½ | .36 |
| **No. 141*** | lb. | **.36** | **.37** |
| No. 160* | lb. | .28½ | .29½ |
| No. 602* | lb. | —— | .30½ |
| No. 603* | lb. | —— | .27 |
| **Sherolatum*** | lb. | .03½ | .06 |
| **Staflex DBES*** | lb. | .58 | .60½ |
| DOS* | lb. | .58 | .60½ |
| IXA* | lb. | .32 | .35 |
| KA* | lb. | .36 | .38¼ |
| Stan Chlor Oils* | lb. | .13½ | .20½ |
| 70* | lb. | .17½ | .30 |
| Stanolind Petrolatum* | lb. | .07 | .156 |
| **Wax*** | lb. | .31 | **.33** |
| **Sunny South Burgundy Pitch*** | lb. | .1030 | .1085 |
| **Rosin Oil*** | gal. | .58 | **.87½** |

## PLASTICIZERS & SOFTENERS (Cont'd)

| | | | |
|---|---|---|---|
| Superla Wax* | lb. | .30 | **.397** |
| Syncera Wax* | lb. | .16 | **.267** |
| **Syn Tac* (c.l.)** | gal. | —— | **.33** |
| **Synthetic Revertant Oil*** | lb. | —— | **.16** |
| **Tar, Refined** | gal. | .1200 | .1760 |
| Tarpine | lb. | .035 | .050 |
| **Terpene A*** | gal. | —— | **.65** |
| TP-90B* | lb. | .59 | .69 |
| TP-95* | lb. | .65 | .75 |
| Transphalt Resins* | lb. | .03¼ | .05¼ |
| Tributyl Phosphate | lb. | .52½ | **.53½** |
| Tricresyl Phosphate | lb. | .32½ | .36 |
| Turgum S* | lb. | .10¼ | .11¾ |
| Vanadiset B* | lb. | .036 | .07 |
| C* | lb. | .031 | .06 |
| MR 80 Mesh* | lb. | .08½ | .12½ |
| **Vistac No. 1*** | gal. | **1.00** | **1.21** |
| **P*** | lb. | **.18** | **.18½** |
| Vopcolene 50* | lb. | —— | .31 |
| Witcizer 100* | lb. | .20¼ | .21¼ |
| 200* | lb. | .20¼ | .21¼ |
| 201* | lb. | .22¾ | .25¼ |
| 300* | lb. | .30 | .33½ |
| 312* | lb. | .30½ | .34 |
| 313* | lb. | .30½ | .34 |
| 412* | lb. | .42½ | .46 |
| Witrosin* | ton | —— | 52.50 |

## PROCESSING AIDS

| | | | |
|---|---|---|---|
| Castor Oil, Blown (dms.) | lb. | —— | **.21** |
| Refined (dms.) | lb. | —— | **.18½** |
| **Castorwax*** | lb. | —— | **.24½** |
| **Dutrex 7*** | lb. | .12 | .20 |
| ELA* | lb. | —— | .82 |
| Hydrofol Glycerides 200* | lb. | .15½ | **.19¼** |
| **Kenflex N*** | lb. | —— | .18 |
| Maleic Anhydride | lb. | —— | .27 |
| **Millrex*** | lb. | —— | .15 |
| Nadic Anhydride | lb. | —— | .75 |
| Polycin* | lb. | —— | **.24½** |
| Resin No. 510* | lb. | .19 | .26 |
| No. 529* | lb. | .25 | .32 |
| **Pulverized*** | lb. | **.20½** | **.25** |
| Thiomalic Acid | lb. | —— | 3.50 |
| Zyrox* | lb. | .78 | .88 |

## PROTECTIVE & STABILIZING AGENTS

| | | | |
|---|---|---|---|
| Acacia* | lb. | .12¼ | .21 |
| Alcogum* | lb. | .08½ | .24 |
| **Alpha Protein** | lb. | —— | **.23** |
| Aroostoocrat* | lb. | —— | .07½ |
| Carob Bean Flour | lb. | —— | .50 |
| Casein | lb. | .32 | .38 |
| Emcol K-8300* (dms.) | lb. | .14 | .18 |
| **Ethylene Diamine 68%** | lb. | **.44** | **.47** |
| Gum Arabic | lb. | —— | .23 |
| Karaya Gum | lb. | —— | .35 |
| Locust Bean Gum | lb. | —— | .50 |
| **Prosein*** | lb. | —— | .06 |
| **Stablex B*** | lb. | **.50** | **.95** |
| **K*** | lb. | **.27** | **.35** |

## RECLAIMING AGENTS

| | | | |
|---|---|---|---|
| Amalgamator Z-4* | lb. | .32 | .33 |
| Armeen C* | lb. | .46 | .52 |
| Mixed Crude* | lb. | .19 | .25 |
| T* | lb. | .32 | .38 |
| Burco RA* | lb | .05 | .081 |
| **C-6 Oil* (28* & 32*)** | gal. | **.33** | **.38** |
| **C-10 Oil*** | gal. | **.25** | **.30** |
| **C-33* (t.c.)** | gal. | —— | **.21½** |
| **C-42* (t.c.)** | gal. | —— | **.23** |
| **Caustic Soda—Flake 76%** (c.l., dms.) | cwt. | —— | 4.50 |
| Liquid 50% (t.c.) | cwt. | —— | 2.80 |
| Solid 76% (c.l., dms.) | cwt. | —— | 4.10 |
| Cresylic Acid (99-100%) | gal. | .85 | 1.39 |
| **D-4* (t.c.)** | gal. | —— | **.27** |
| **E-5* (t.c.)** | gal. | —— | **.25** |
| **Flake Calcium Chloride** (77-80%) | ton | —— | 29.00 |
| G.B. Reclaiming Oil* | gal. | .19½ | .21½ |
| CD-10* | gal. | .17½ | .19½ |
| CD-50-U* | gal. | .25½ | .27½ |
| **Gensol No. 6* (t.c.)** | gal. | —— | **.40** |
| Heavy Aromatic Naphtha | gal. | .13¼ | .18½ |
| **LX-77 Reclaiming Solvent*** | gal. | .21 | **.33** |
| **LX-572 Reclaiming Oil*** | gal. | **.27** | **.32** |
| **LX-777 Reclaiming Oil*** | gal. | **.23** | **.33** |
| **Neo-Fat D-242*** | lb. | **.05½** | **.07¾** |
| 42-70* | lb. | .08¼ | .10¼ |
| **No. 517 H.B. Oil*** | gal. | **.11½** | **.16½** |
| 535* | gal. | **.22** | **.27** |
| **PT 67 Light Pine Oil* (dms.)** | gal. | —— | **.60** |
| PT 101 Pine Tar Oil* (t.c., dms.) | gal. | .0460 | .0634 |
| **PT 150 Pine Solvents* (dms.)** | gal. | —— | **.44** |
| **Q Oil* (t.c.)** | gal. | —— | **.286** |
| **Reclaiming Oil 3186-G*** | gal. | **.25** | **.36½** |
| **Reclaiming Reagent No. 1431*** | lb. | **.21** | **.25** |
| **R.P.A. No. 3*** | lb. | —— | **.47** |
| RR-10* | lb. | —— | .37 |
| Soda Ash (c.l., bags) | cwt. | —— | 1.75 |
| **Solvent 534*** | gal. | **.20½** | **.26½** |
| **Solvent Oil 21*** | gal. | **.24** | **.29** |
| C-42* | gal. | .23 | .38 |
| X-1 Resinous Oil* | lb. | .0225 | .0325 |

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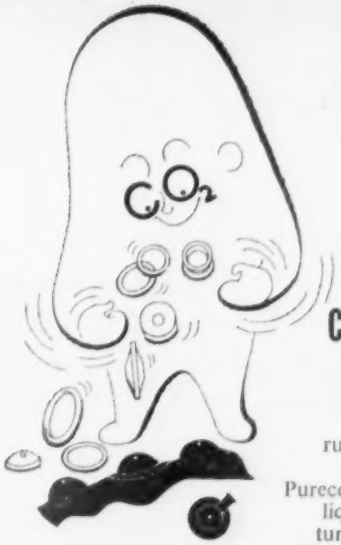


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## REINFORCING AGENTS—CARBON BLACK

### Channel, Hard Processing (HPC) (bags)

| | | | |
|---|---|---|---|
| Atlantic HPC-98* | lb. | .0775 | .1450 |
| Continental F* | lb. | .0775 | .1450 |
| Croflex* | lb. | .0775 | .1450 |
| Dixiedensed (and S)* | lb. | .0775 | .1450 |
| Kosmobile (and S)* | lb. | .0775 | .1450 |
| Micronex HPC* | lb. | .0775 | .1450 |
| Witco No. 6* | lb. | .0775 | .1450 |

### Channel, Medium Processing (MPC) (bags)

| | | | |
|---|---|---|---|
| Arrow MPC* | lb. | .0775 | .1350 |
| Atlantic MPC-95* | lb. | .0775 | .1450 |
| Continental A* | lb. | .0775 | .1450 |
| Croflex TH* | lb. | .0775 | .1450 |
| Dixiedensed HR (and S-66) | lb. | .0775 | .1450 |
| Kosmobile HM (and S-66) | lb. | .0775 | .1450 |
| Micronex Standard* | lb. | .0775 | .1450 |
| Spheron 6* | lb. | .0775 | .1450 |
| Texas M* | lb. | .0775 | .1450 |
| Witco No. 1* | lb. | .0775 | .1450 |

### Channel, Easy Processing (EPC) (bags)

| | | | |
|---|---|---|---|
| Atlantic EPC E-42* | lb. | .0775 | .1450 |
| Collocarb* | lb. | .0590 | .1400 |
| Continental AA* | lb. | .0775 | .1450 |
| Croflex 77* | lb. | .0775 | .1450 |
| Dixiedensed 77* | lb. | .0775 | .1450 |
| Kosmobile 77* | lb. | .0775 | .1450 |
| Micronex W-6* | lb. | .0775 | .1450 |
| Spheron 9* | lb. | .0775 | .1450 |
| Texas E* | lb. | .0775 | .1450 |
| Witco No. 12* | lb. | .0775 | .1450 |
| Wyex EPC* | lb. | .0775 | .1350 |

### Channel, Conductive (CC) (bags)

| | | | |
|---|---|---|---|
| Continental R-40* | lb. | .2600 | .3400 |
| Dixie 5 Dustless* | lb. | .1350 | .2100 |
| Dixie Voltex* | lb. | .2600 | .3400 |
| Kosmink Dustless* | lb. | .1350 | .2100 |
| Kosmos Voltex* | lb. | .2600 | .3400 |
| Spheron C* | lb. | .1800 | .2400 |
| Voltex* | lb. | .2600 | .3400 |

### Channel, Surface Treated (STC) (bags)

| | | | |
|---|---|---|---|
| Texas 109* | lb. | .0840 | .1475 |

### Conductive Furnace Black (CF) (bags)

| | | | |
|---|---|---|---|
| Aromex CF* | lb. | .0875 | .1450 |
| Atlantic CF* | lb. | .0875 | .1450 |
| Continex CF* | lb. | .1050 | .1550 |
| Croflex CF* | lb. | .0875 | .1450 |
| Dixie CF* | lb. | .0875 | .1450 |
| Kosmos CF* | lb. | .0875 | .1450 |
| Shawinigan Acetylene Black* | lb. | —— | .1900 |
| Vulcan C* | lb. | .1100 | .1750 |

### Extra-Conductive Furnace Black (ECF) (bags)

| | | | |
|---|---|---|---|
| Vulcan XC-72 | lb. | .1775 | .2700 |

### Furnace, Fast Extruding (FEF) (bags)

| | | | |
|---|---|---|---|
| Arovel FEF* | lb. | .0675 | .1250 |
| Continex FEF* | lb. | .0675 | .1250 |
| Croflex 50* | lb. | .0675 | .1250 |
| Dixie 50* | lb. | .0675 | .1250 |
| Kosmos 50* | lb. | .0675 | .1250 |
| Philblack A* | lb. | .0675 | .1200 |
| Statex M* | lb. | .0675 | .1250 |
| Sterling SO* | lb. | .0675 | .1250 |

### Furnace, Fine (FF) (bags)

| | | | |
|---|---|---|---|
| Statex B* | lb. | .0725 | .1300 |
| Sterling 99* | lb. | .0725 | .1300 |

### Furnace, General Purpose (GPF) (bags)

| | | | |
|---|---|---|---|
| Arogen GPF* | lb. | .0600 | .1175 |
| Dixie 35* | lb. | .0600 | .1175 |
| Kosmos 35* | lb. | .0600 | .1175 |
| Sterling V* | lb. | .0600 | .1175 |
| V (Non-Staining) | lb. | .0600 | .1175 |

### Furnace, High Abrasion (HAF) (bags)

| | | | |
|---|---|---|---|
| Aromex HAF* | lb. | .0775 | .1350 |
| Continex HAF* | lb. | .0775 | .1350 |
| Croflex 60* | lb. | .0775 | .1350 |
| Dixie 60* | lb. | .0775 | .1350 |
| Kosmos 60* | lb. | .0775 | .1350 |
| Philblack O* | lb. | .0775 | .1300 |
| Statex R* | lb. | .0775 | .1350 |
| Vulcan 3* | lb. | .0775 | .1350 |

### Furnace, High Modulus (HMF) (bags)

| | | | |
|---|---|---|---|
| Continex HMF* | lb. | .0675 | .1200 |
| Croflex 40* | lb. | .0675 | .1250 |
| Dixie 40* | lb. | .0675 | .1250 |
| Kosmos 40* | lb. | .0675 | .1250 |
| Modulex HMF* | lb. | .0675 | .1200 |
| Statex 93* | lb. | .0675 | .1200 |
| 930* | lb. | .0675 | .1200 |
| Sterling L* | lb. | .0675 | .1200 |
| LL* | lb. | .0675 | .1200 |

## REINFORCING AGENTS—CARBON BLACK (Cont'd)

### Furnace, Semi-Reinforcing (SRF) (bags)

| | | | |
|---|---|---|---|
| Continex SRF* | lb. | .0575 | .1150 |
| Croflex 20* | lb. | .0575 | .1150 |
| Dixie 20* | lb. | .0575 | .1150 |
| Essex SRF* | lb. | .0575 | .1150 |
| Furnex* | lb. | .0575 | .1150 |
| Gastex* | lb. | .0525 | .1200 |
| Kosmos 20* | lb. | .0575 | .1150 |
| Pelletex* | lb. | .0525 | .1100 |
| NS* | lb. | .0525 | .1100 |
| Shawinigan Acetylene Black* | lb. | —— | .1900 |
| Sterling NS* | lb. | .0575 | .1150 |
| R* | lb. | .0625 | .1250 |
| S* | lb. | .0575 | .1150 |

### Furnace Super Abrasion (SAF) (bags)

| | | | |
|---|---|---|---|
| Dixie 85 | lb. | .1150 | .1650 |
| Kosmos 85 | lb. | .1150 | .1650 |
| Philblack E* | lb. | .1150 | .1550 |
| Vulcan 9* | lb. | .1150 | .1800 |

### Furnace, Super Abrasion, Intermediate (ISAF) (bags)

| | | | |
|---|---|---|---|
| Aromex ISAF* | lb. | .0925 | .1500 |
| Continex ISAF* | lb. | .0925 | .1500 |
| Dixie 70* | lb. | .0925 | .1500 |
| Kosmos 70* | lb. | .0925 | .1500 |
| Philblack I* | lb. | .0925 | .1450 |
| Statex 125* | lb. | .0925 | .1500 |
| Vulcan 6* | lb. | .0925 | .1500 |

### Furnace, Super Conductive (SCF) (bags)

| | | | |
|---|---|---|---|
| Vulcan SC* | lb. | .1800 | .24$ |

### Thermal, Fine (FT) (bags)

| | | | |
|---|---|---|---|
| P-33 (c.l.)* | lb. | —— | .0575 |
| Sterling FT (c.l.)* | lb. | —— | .0575 |

### Thermal, Medium (MT) (bags)

| | | | |
|---|---|---|---|
| Shellblack*(†) | lb. | —— | .0250 |
| Sterling MT (c.l.)* | lb. | —— | .0400 |
| MT Non-Staining (c.l.)* | lb. | —— | .0500 |
| Thermax (c.l.)* | lb. | —— | .0400 |
| Stainless (c.l.) | lb. | —— | .0500 |

## REINFORCING AGENTS—SILICA

| | | | |
|---|---|---|---|
| Cab-O-Sil (compressed)* | lb. | .68 | .75 |
| Cab-O-Sil (uncompressed)* | lb. | .68 | .75 |
| D. C. Silica (pelletized)* | lb. | 1.45 | 1.65 |
| Hi-Sil 101* | lb. | .14 | .15½ |
| 233* | lb. | .09 | .10½ |
| X303* | lb. | .40 | .45 |
| Santocel* | lb. | .62 | .64 |
| Valron Estersil* | lb. | 2.00 | 2.25 |

## REINFORCING AGENTS—MISCELLANEOUS

| | | | |
|---|---|---|---|
| Angelo Shellac* | lb. | .50 | .60 |
| Darex Copolymer No. 3* | lb. | .47 | .49 |
| 43G* | lb. | .39 | .41 |
| Darex Copolymer Latex No. J-L | lb. | .41½ | .46 |
| Durez 12687 (and 12707)* | lb. | —— | .38½ |
| Durez 13355* | lb. | —— | .30 |
| Good-rite Resin 50* | lb. | .39 | .41 |
| Hystron* | lb. | .39 | .41 |
| Kralac A-EP* | lb. | .39 | .41 |
| Lampblack | lb. | —— | .12 |
| Marbon S and S-1* | lb. | .39 | .41 |
| 8000* | lb. | .39 | .41 |
| Marmix* | lb. | .39 | .41 |
| Pliolite Latex 150* | lb. | .35 | .39 |
| Pliolite Resin-Rubber Masterbatches* | lb. | .33 | .57 |
| Pliolite NR* | lb. | .93 | .95 |
| S6B* | lb. | .39 | .41 |
| Plio-Tuf G85C* | lb. | .52 | .54 |
| Polyco 220* | lb. | .18¼ | .19¼ |
| Polypol S-70* | lb. | .22 | .23 |

## RETARDERS

| | | | |
|---|---|---|---|
| Benzoic Acid TBAO-2* | lb. | —— | .44 |
| Dutch Boy Normasal* | lb. | —— | .46 |
| ESEN* | lb. | .35 | .37 |
| Good-rite Vultrol* | lb. | .62 | .64 |
| Harcopol 1183* | lb. | .70 | .74 |
| Retarder J* | lb. | .62 | .64 |
| PD* | lb. | .37 | .39 |
| W* | lb. | —— | .42 |
| Retardex* | lb. | .47 | .50 |
| Wiltrol P | lb. | .37 | .39 |

## RUBBER SUBSTITUTES

### Mineral Rubber

| | | | |
|---|---|---|---|
| Byerlyte* | ton | 50.00 | 57.00 |
| Hard Hydrocarbon (dms.)* | ton | 53.00 | 55.00 |
| Herron Flake* | ton | —— | 45.00 |
| Mineral Rubber, Solid | ton | 42.50 | 44.50 |
| M. R. No. 38* | ton | 55.00 | 65.00 |
| Witresin | ton | —— | 52.50 |

### Vulcanized Vegetable Oils

| | | | |
|---|---|---|---|
| Amberex* | lb. | .29 | .36 |
| Brown | lb. | .15 | .24 |
| Car-Bel-Lite* | lb. | .3000 | .3300 |
| Neophax* | lb. | .17 | .27 |
| Polyrez A and C* | lb. | .12 | .17 |
| White | lb. | .15 | .26 |

### Miscellaneous Rubber Substitutes

| | | | |
|---|---|---|---|
| G.B. Asphaltenes* | lb. | .06 | .06½ |
| Gilsowax B* | lb. | .09 | .11 |
| Resin No. 1098 (dms.) | lb. | —— | .62 |
| No. 1198* | lb. | .46¾ | .49¼ |
| Tysonite* | lb. | .26 | .26¾ |

## SOLVENTS

| | | | |
|---|---|---|---|
| Acetone (dlvd.) | lb. | .10½ | .11½ |
| Amsco Lactol Spirits* (t.c.) | gal. | —— | .19 |
| Naphthol Spirits* | gal. | —— | .18 |
| Mineral Spirits* | gal. | —— | .17 |
| Rubber Solvent* (t.c.) | gal. | —— | .18 |
| Solv A* (t.c.) | gal. | —— | .24½ |
| Solv A-80* (t.c.) | gal. | —— | .30 |
| Solv B* (t.c.) | gal. | —— | .28½ |
| Solv B-90* (t.c.) | gal. | —— | .32 |
| Solv D* (t.c.) | gal. | —— | .30 |
| Solv E* | gal. | —— | .30 |
| Solv F* | gal. | —— | .30 |
| Solv F-80* | gal. | —— | .32½ |
| Solv G* | gal. | —— | .42½ |
| Special Naphtholite* (t.c.) | gal. | —— | .18 |
| Special Textile Spirits* | gal. | —— | .19 |
| Super Hi-Flash Naphtha* | gal. | —— | .35 |
| Super Naphtholite* | gal. | —— | .18 |
| Textile Spirits* (t.c.) | gal. | —— | .19 |
| Amyl Chlorides, Mixed (t.c.l.) (dms.) | lb. | —— | .11 |
| Benzol 90% | gal. | .36 | .40 |
| Butyl Acetate (t.c.) | lb. | —— | .13½ |
| Butyl Alcohol (t.c.) | lb. | —— | .13½ |
| Secondary (dlvd.) | lb. | .14½ | .15½ |
| Tertiary (dlvd.) | lb. | .14½ | .15½ |
| Carbon Bisulfide, Tech. | lb. | .05½ | .07½ |
| Carbon Tetrachloride | lb. | .10 | .13½ |
| Cosol 1* | gal. | .37 | .43 |
| 2* | gal. | .42 | .48 |
| Cyclohexane | gal. | .55 | .72 |
| 85% (c.l.) (dms.) | gal. | —— | .56 |
| Cyclohexanone | lb. | .29 | .31½ |
| Diacetone, Pure (dlvd.) | lb. | .15 | .16 |
| Dichlorethyl Ether (dms.) | lb. | .14½ | .15 |
| Formal (dms.) | lb. | .30¾ | .31¾ |
| Dichloropentanes (t.c.l.) (dms.) | lb. | —— | .06 |
| Dicom* | gal. | —— | .50 |
| Halowax Oil* | lb. | .28 | .41 |
| Heptanes* (t.c.) | gal. | .19 | .22 |
| Hexanes (t.c.) | gal. | .19 | .22 |
| Isopropyl Alcohol, Ref. 99% (dlvd.) | gal. | .57 | .64 |
| Ether, Ref. (dlvd.) | lb. | .09½ | .10½ |
| Mersol* | gal. | .43 | .7( |
| Mesityl Oxide (dlvd.) | lb. | .14½ | .15½ |
| Methyl Acetone, Syn. (dms., dlvd.) | gal. | .57 | .63 |
| Methyl Chloride | lb. | —— | .11½ |
| Methyl Ethyl Ketone | lb. | .14½ | .15½ |
| Methyl Isobutyl Ketone (dlvd.) | lb. | .16½ | .17½ |
| Methylene Chloride | lb. | .11¾ | .16 |
| N-5 Pentane Mix* (t.c.) | gal. | —— | .13½ |
| N-6 Hexanes* (t.c.) | gal. | —— | .14½ |
| N-7 Hexanes* (t.c.) | gal. | —— | .13½ |
| Penetrell* | gal. | .45 | .73 |
| Perchlorethylene | lb. | .11½ | .14½ |
| Petrolene* (t.c.) | gal. | —— | .14125 |
| Picolines, Alpha, Refined | lb. | .43½ | .44 |
| Mixed | lb. | .32½ | .33 |
| Proprietary Solvent (dms.) | gal. | .66 | .77 |
| Propyl Acetate (t.c., dlvd.) | lb. | —— | .11¾ |
| Alcohol (t.c., dlvd.) | lb. | —— | .11 |
| PT 150 Pine Solvent* (dms.) | gal. | —— | 44 |
| Pyridine, Refined | lb. | .74½ | .75 |
| Quinoline | lb. | .50 | .54¼ |
| Rubber Solvent (t.c.) | gal. | —— | .16 |
| Rubsol (t.c.) | gal. | —— | .12875 |
| Skellysolve B (Hexanes)* (t.c.) | gal. | —— | .158 |
| C (Heptanes)* (t.c.) | gal. | —— | .151 |
| R (Rubber Solvent)* | gal. | —— | 1.29 |
| Solvent, Crude, Light | gal. | .19 | .28 |
| Solvesso 100* (t.c.) | gal. | .33 | .35 |
| 150 (t.c.) | gal. | .33 | —— |
| Sunny South DD Dipentine* | gal. | .45 | .73 |
| Sunny South DD Pine Oil* | lb. | .15½ | .1780 |

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### SOLVENTS (Cont'd)

| | | | | |
|---|---|---|---|---|
| **Sunray*** | gal. | .1140 | - | .1600 |
| **Toluene (dms.)** | gal. | —— | - | .38 |
| Toluol (t.c.) | gal. | .33 | - | .35 |
| **Trichlorethane** | lb. | .13 | - | .13½ |
| **Triglycol Dichloride** | lb. | .63 | - | .64 |
| Union Thinner 1° (t.c.) | gal. | —— | - | .174 |
| 5° (dms.) | gal. | —— | - | .199 |
| 7° (t.c.) | gal. | —— | - | .164 |
| **2-50 W Hi-Flash*** | gal. | —— | - | .41 |
| **Xylol** | gal. | .34 | - | .38 |

### STABILIZING AGENTS (for Vinyl Resins)

| | | | | |
|---|---|---|---|---|
| Advastab BC-12* | lb. | .90 | - | .95 |
| BC-74* | lb. | .70 | - | .75 |
| BC-105* | lb. | .75 | - | .80 |
| CH-101* | lb. | .60 | - | .65 |
| CH-201* | lb. | .60 | - | .65 |
| E-82* | lb. | .90 | - | .95 |
| JCX* | lb. | .62 | - | .67 |
| L Paste* | lb. | .65 | - | .70 |
| SN* | lb. | .47 | - | .52 |
| T-10* | lb. | 1.90 | - | 1.95 |
| T-50-LT* | lb. | 3.20 | - | 3.25 |
| XBZ-155* | lb. | .69 | - | .74 |
| XC-143* | lb. | .90 | - | .95 |
| XE-98* | lb. | .53 | - | .58 |
| Barca 10* | lb. | .75 | - | .80 |
| **Barium Ricinoleate (BVS)** | lb. | —— | - | .70 |
| Barium Stearate | lb. | .39 | - | .44 |
| Basic Silicate White Lead | lb. | .20¾ | - | .21¾ |
| **Cadmium Ricinoleate** | lb. | —— | - | 2.00 |
| **Calcium Ricinoleate** | lb. | —— | - | .55 |
| **Dutch Boy DS-207*** | lb. | —— | - | .54 |
| **Plumb-O-Sil A*** | lb. | —— | - | .29¾ |
| **B*** | lb. | —— | - | .31¼ |
| **Tribase*** | lb. | —— | - | .26½ |
| **Dythal*** | lb. | —— | - | .39½ |
| Ferro 182* (dms.) | lb. | .70 | - | .76 |
| **200* (dms.)** | lb. | 1.33 | - | 1.43 |
| 203* (dms.) | lb. | .85 | - | .95 |
| 541* (dms.) | lb. | .35½ | - | .45½ |
| 541A* (dms.) | lb. | .81¾ | - | .91¾ |
| **700* (dms.)** | lb. | .48¾ | - | .58¾ |
| 900* (dms.) | lb. | .90 | - | 1.00 |
| 903* (dms.) | lb. | .55 | - | .65 |
| 909* (dms.) | lb. | .91 | - | 1.01 |
| **920*** | lb. | —— | - | .98 |
| **931* (dms.)** | lb. | .75¾ | - | .85¾ |
| 993* (dms.) | lb. | .89 | - | .99 |
| 1203* (dms.) | lb. | 1.30 | - | 1.40 |
| 1206* (dms.) | lb. | 1.23 | - | 1.33 |
| 1820* (dms.) | lb. | .90 | - | 1.00 |
| 1825* (dms.) | lb. | 1.00 | - | 1.10 |
| Permyl A | lb. | .45 | - | .55 |
| Harshaw 1-V-3* | lb. | .43 | - | .45 |
| 1-V-4* | lb. | .66½ | - | .70 |
| 1-V-7* | lb. | .66 | - | .68 |
| 2-V-4* | lb. | .85 | - | .87 |
| **2-V-7*** | lb. | —— | - | 1.10 |
| **2-V-8*** | lb. | —— | - | 1.30 |
| 5-V-1* | lb. | .41 | - | .43 |
| **7-V-1*** | lb. | —— | - | .90 |
| 8-V-1* | lb. | .88 | - | .90 |
| **8-V-5*** | lb. | —— | - | .80 |
| 8-V-100* | lb. | .82 | - | .84 |
| 9-V-1* | lb. | .70 | - | .72 |
| 12-V-5* | lb. | .73 | - | .75 |
| 24-V-1* | lb. | 1.10 | - | 1.12 |
| **28-V-2*** | lb. | —— | - | 1.18 |
| 128-V-5* | lb. | .86 | - | .88 |
| Lithium Stearate | lb. | .52 | - | .57 |
| Fluffy | lb. | .47½ | - | .70 |
| Standard | lb. | .52½ | - | .75 |
| Mark C* | lb. | .88 | - | .90 |
| E* | lb. | .72 | - | .75 |
| M* | lb. | .68 | - | .70 |
| PL* | lb. | .63 | - | .65 |
| TT* | lb. | .72 | - | .75 |
| WS* | lb. | .98 | - | 1.00 |
| X* | lb. | 2.50 | - | 2.75 |
| XI* | lb. | .87 | - | .90 |
| XV* | lb. | .88 | - | .90 |
| XX* | lb. | .58 | - | .60 |
| **Metasap 613-A*** | lb. | —— | - | .69 |
| **613-B*** | lb. | —— | - | .84 |
| **613-C*** | lb. | —— | - | 1.06 |
| **621*** | lb. | —— | - | .88 |
| **624*** | lb. | —— | - | .75 |
| **633*** | lb. | —— | - | .75 |
| **635*** | lb. | —— | - | .45 |
| **Modicol N*** | lb. | .41½ | - | .42½ |
| **S*** | lb. | .30½ | - | .31½ |
| Sodium Silicates 41°/1:32 | cwt. | 1.00 | - | 2.10 |
| **Stabelan E*** | lb. | 1.35 | - | 1.50 |
| **XL*** | lb. | .55 | - | .65 |
| **HR-50*** | lb. | .75 | - | .90 |
| **HR Liquid*** | lb. | .65 | - | .75 |
| **HR Paste*** | lb. | .85 | - | .95 |
| **HR Powder*** | lb. | .95 | - | 1.05 |
| No. 110 Liquid | lb. | .65 | - | .75 |
| No. 115 Liquid | lb. | .85 | - | .95 |
| No. 120 Liquid | lb. | .65 | - | .75 |
| Stabilizer No. 52* | lb. | 1.90 | - | 2.00 |
| 89X* | lb. | .75 | - | .80 |
| B-5* | lb. | —— | - | .70 |
| E6B* | lb. | —— | - | .95 |
| G-1* | lb. | 1.25 | - | 1.40 |
| HR* | lb. | .85 | - | .89 |
| L* | lb. | —— | - | .60 |
| OM-10* | lb. | —— | - | 1.95 |
| Staflex OY* | lb. | 1.00 | - | 1.20 |
| **QXMA*** | lb. | —— | - | .70 |

### STABILIZING AGENTS (Cont'd)

| | | | | |
|---|---|---|---|---|
| Stayrite 10* | lb. | .34 | - | .36 |
| P-10* | lb. | .41 | - | .43 |
| 15* | lb. | .53 | - | .58 |
| 20* | lb. | .37 | - | .42 |
| 22* | lb. | 1.00 | - | 1.13 |
| 25* | lb. | .35 | - | .40 |
| 70* | lb. | .68 | - | .70 |
| 71* | lb. | .88 | - | .90 |
| 75* | lb. | .59 | - | .62 |
| 76* | lb. | .53 | - | .55 |
| 80* | lb. | .68 | - | .70 |
| 90* | lb. | .68 | - | .70 |
| 95* | lb. | .68 | - | .70 |
| 229* | lb. | .45 | - | .50 |
| Vanstay C-73* | lb. | .63 | - | .65 |
| HT* | lb. | .90 | - | .92 |
| L* | lb. | .33 | - | .35 |
| N* | lb. | .98 | - | 1.00 |
| R* | lb. | .70 | - | .72 |
| S* | lb. | .63 | - | .65 |
| Z* | lb. | .67 | - | .69 |

### STIFFENING AGENTS

| | | | | |
|---|---|---|---|---|
| Polyac* | lb. | —— | - | 1.80 |
| Processing Stiffener 710* | lb. | —— | - | .88 |
| Solvitose HDF, H, C-S, T, and E* | lb. | .22 | - | .25 |
| Versatil Gum 8-E* | lb. | .15 | - | .19 |

### SUN CHECKING AGENTS

| | | | | |
|---|---|---|---|---|
| Allied AA-1144* | lb. | .23 | - | .24 |
| AA-1177* | lb. | .15½ | - | .16½ |
| Antisol* | lb. | —— | - | .23 |
| Antisun* (Chipped) | lb. | .15½ | - | .17½ |
| (Slabbed) | lb. | .15 | - | .17 |
| Heliozone* | lb. | .31 | - | .32 |
| Microflake* | lb. | .20 | - | .24 |
| Nacconol NRSF* | lb. | .40½ | - | .45 |
| NBC* | lb. | —— | - | 1.55 |
| Ross Sunproofing Waxes* | lb. | —— | - | .14½ |
| Sunolite* | lb. | .16 | - | .22 |
| 127* | lb. | .16½ | - | .20½ |
| 154* | lb. | .23 | - | .25 |
| Sunproof* | lb. | .31 | - | .32 |
| 713* | lb. | .25 | - | .26 |
| Improved* | lb. | .25 | - | .26 |
| Super* | lb. | .40 | - | .41 |
| Jr.* | lb. | .20 | - | .21 |
| Tonox* | lb. | .52 | - | .54 |

### SURFACE ACTIVE AGENTS

| | | | | |
|---|---|---|---|---|
| Anhydrapent* | lb. | .56 | - | .59 |
| Anhydrol 6990* | lb. | .51 | - | .56 |
| 6991* | lb. | .51 | - | .56 |
| Aquarex D* | lb. | —— | - | .78 |
| G* | lb. | —— | - | .21 |
| MDL* | lb. | —— | - | .33 |
| ME* | lb. | —— | - | .80 |
| NS* | lb. | —— | - | .60 |
| SMO* | lb. | —— | - | .50 |
| WAQ* | lb. | —— | - | .22 |
| Emulphor EL-620* | lb. | —— | - | .40 |
| EL-719* | lb. | —— | - | .58 |
| ON-870* | lb. | —— | - | .55 |
| Igepal CA-630 | lb. | —— | - | .29 |
| CO-630 | lb. | —— | - | .29 |
| CO-730 | lb. | —— | - | .29 |
| CO-850* | lb. | —— | - | .29 |
| CO-880* | lb. | —— | - | .29 |
| Igepon CN-42* | lb. | —— | - | .25 |
| T-33* | lb. | —— | - | .21 |
| T-51* | lb. | —— | - | .13½ |
| T-77* | lb. | —— | - | .49 |
| Kessco 50201* | lb. | —— | - | .43½ |
| 50203* | lb. | —— | - | .46 |
| 18201* | lb. | —— | - | .36½ |
| 18203* | lb. | —— | - | .36 |
| Pluronic L62* | lb. | .33½ | - | .39 |
| L64* | lb. | .33½ | - | .39 |
| Sellogen Gel* | lb. | —— | - | .12¼ |
| Soybean Lecithin | lb. | .13 | - | .17 |

### TACKIFIERS

| | | | | |
|---|---|---|---|---|
| Amalgamator Z-4* | lb. | .32 | - | .33 |
| Arreco 620-32B* | lb. | .20½ | - | .21½ |
| 716-30* | lb. | .18½ | - | .19½ |
| 1041-21* | lb. | .16½ | - | .17½ |
| A-26* | lb. | .18 | - | .19 |
| Bunaweld Polymer No. 780* | lb. | —— | - | .24 |
| No. 5514* | lb. | —— | - | .35 |
| Galex* (dms.) | lb. | .17¾ | - | .18¾ |
| Indopol H-300* | gal. | 1.00 | - | 1.22 |
| Koresin* | lb. | —— | - | .95 |
| Liquid Rubber Flux* | lb. | —— | - | .14 |
| Nacconal NRSF* (dlvd.) | lb. | .40½ | - | .45 |
| Nilox Resin* (c.l.) | cwt. | —— | - | 14.50 |
| Resin V | lb. | —— | - | .23½ |
| Synthol* | lb. | .17 | - | .24¾ |
| Vistac A* | lb. | .21½ | - | .22¼ |
| Vistanex LM Grades* | lb. | —— | - | .45 |
| Zirex* (c.l.) | cwt. | —— | - | 14.75 |

### THICKENERS (For Latex)

| | | | | |
|---|---|---|---|---|
| Alcogum AN-6* | lb. | —— | - | .05 |
| AN-10* | lb. | —— | - | .08½ |
| PA-10* | lb. | —— | - | .12 |
| Betanol* (dms.) | lb. | .70 | - | .95 |
| Gomme Labolene* | lb. | .45 | - | .47 |
| Good-rite K-702* | lb. | .34½ | - | .35 |
| K-704* | lb. | .21 | - | .22 |
| K-705* | lb. | .31 | - | .32 |
| K-707* | lb. | .18 | - | .19 |
| K-708* | lb. | .29 | - | .30 |
| K-710* | lb. | .15 | - | .16 |

### THICKENERS (For Latex) (Cont'd)

| | | | | |
|---|---|---|---|---|
| Modicol VD* | lb. | .13⅜ | - | .14⅜ |
| VE* | lb. | .13⅜ | - | .14⅜ |
| Polyco 296 BT* | lb. | .15 | - | .16 |
| 296-N* | lb. | .15 | - | .16 |
| 530* | lb. | .15 | - | .16 |
| Propylene Laurate (dms.) | lb. | .57 | - | .82 |
| Sodium Silicate, 41°/1:3.2 | cwt. | 1.10 | - | 2.20 |
| Solvitose Series* | lb. | .22 | - | .25 |

### VULCANIZING AGENTS

**Selenium**

| | | | | |
|---|---|---|---|---|
| Vandex* | lb. | —— | - | 15.50 |

**Sulfur**

| | | | | |
|---|---|---|---|---|
| Aero Brand* (c.l.) | cwt. | —— | - | 2.65 |
| Blackbird* (c.l.) | cwt. | —— | - | 2.85 |
| Cloud* (c.l.) | cwt. | —— | - | 2.80 |
| Crystex* | lb. | .19½ | - | .23 |
| Darex Dispersed Sulfur* | lb. | .14 | - | .16 |
| Devil A* (c.l.) | cwt. | —— | - | 2.40 |
| Dispersed Sulfur | lb. | .14 | - | .16 |
| Insoluble Sulfur 60* | lb. | .12½ | - | .13 |
| Ko-Blend IS* | lb. | —— | - | .39 |
| Mist* (Wettable) (c.l.) | cwt. | —— | - | 4.00 |
| Spider* (c.l.) | cwt. | —— | - | 2.80 |
| Star* (c.l.) | cwt. | —— | - | 3.25 |
| Sulfasan R* | lb. | —— | - | 1.50 |
| Tire* (c.l.) | cwt. | —— | - | 2.40 |
| Tube* (c.l.) | cwt. | —— | - | 3.25 |
| Vultac 2* | lb. | .47 | - | .49 |
| 3* | lb. | .51 | - | .53 |

**Tellurium**

| | | | | |
|---|---|---|---|---|
| Telloy* | lb. | —— | - | 2.50 |

### WETTING AGENTS

| | | | | |
|---|---|---|---|---|
| Advawet No. 10* | lb. | —— | - | .17 |
| No. 33* | lb. | —— | - | .48 |
| Aerosol 18* | lb. | —— | - | .40 |
| AY* | lb. | 1.00 | - | 1.20 |
| MA 80%* | lb. | .67 | - | .72 |
| OS* | lb. | .39 | - | .45 |
| OT 75% Aqueous* | lb. | .63 | - | .68 |
| OT 100%* | lb. | 1.00 | - | 1.20 |
| OT-B* | lb. | .85 | - | 1.05 |
| Alrosal* (dms.) | lb. | —— | - | .40 |
| Alrosperse* | lb. | —— | - | .18 |
| Anhydrol 6990* and 6991* | lb. | .51 | - | .56 |
| Areskap 50* | lb. | .30 | - | .32 |
| Dry 100* | lb. | .60 | - | .64 |
| Aresket Dry 300* | lb. | .60 | - | .64 |
| Aresklene 375* | lb. | .42 | - | .47 |
| Armacs* | lb. | .28 | - | .77 |
| Arquads* | lb. | .42 | - | .61 |
| Emcol 5100* (dms.) | lb. | —— | - | .31 |
| Energetic W-100 | lb. | .28½ | - | .35 |
| Etho-Chemicals* | lb. | .26 | - | .58 |
| Ethomeen S/15* | lb. | .48 | - | .50 |
| T/15* | lb. | .46 | - | .48 |
| Kesco E-122* (dms) | lb. | —— | - | .45 |
| 18201* | lb. | —— | - | .38½ |
| Kreelon 4D* (dms.) | lb. | .13 | - | .16 |
| 8G* (dms.) | lb. | .26 | - | .28 |
| Kyro EO* (dms.) | lb. | —— | - | .29½ |
| Modicol N* | lb. | .41½ | - | .42½ |
| S* | lb. | .30½ | - | .31½ |
| Nacconol SL* (dlvd.) | lb. | .084 | - | .10 |
| 60S* (dlvd.) | lb. | .19 | - | .225 |
| Nacconol A* (dlvd.) | lb. | —— | - | .52 |
| Nekal WS-23 | lb. | —— | - | .38 |
| WS-99 | lb. | —— | - | .95 |
| Orvus AB Granules* | lb. | .15¾ | - | .16¾ |
| Parnol* | lb. | .13 | - | .18 |
| Regal Beads | lb. | .12¼ | - | .16¼ |
| H. D. Beads | lb. | .12¾ | - | .15¾ |
| Santomerse No. 3 | lb. | .41 | - | .45 |
| S* | lb. | 1.55 | - | 1.85 |
| Selapon Gel* | lb. | —— | - | .13 |
| Sorapon SF-73* | lb. | —— | - | .18 |
| SF-78* | lb. | —— | - | .30 |
| Sorbit P* | lb. | —— | - | .28 |
| Soybean Lecithin | lb. | .13 | - | .17 |
| Stablex G* | lb. | .50 | - | .90 |
| Tergitol 4* (dms., dlvd.) | lb. | .32 | - | .33 |
| 7* (dms., dlvd.) | lb. | .43 | - | .44 |
| O8* (dms., dlvd.) | lb. | .31 | - | .32 |
| P28* (dms., dlvd.) | lb. | .18½ | - | .19 |
| Trenamine W-30 | lb. | —— | - | .15 |
| Vultamol* | lb. | —— | - | .17½ |
| Wetsit Conc.* | lb. | .25 | - | .28 |

### MISCELLANEOUS CHEMICALS

| | | | | |
|---|---|---|---|---|
| Aquesperse 30* | lb. | —— | - | .11 |
| Arccopel W-18* | lb. | .17 | - | .19 |
| Asbury Graphite* | lb. | .05 | - | 1.45 |
| Copper Inhibitor X-872-L* | lb. | —— | - | 2.01 |
| D-Tac* | lb. | —— | - | .22 |
| 2-Ethyl Hexanol | lb. | .23¾ | - | .24¼ |
| Fura-Tone Resin 1226* | lb. | .41 | - | .43 |
| MODX* | lb. | .32½ | - | .34½ |
| Nacconates* (dms.) | lb. | .99 | - | 3.53 |
| Para Resins* | lb. | .04 | - | .04½ |
| Pigmented Filmite* (dlvd.) | lb. | .16¾ | - | —— |
| Resorcin, Tech. | lb. | .77½ | - | .81¼ |
| Rio Resin* | lb. | .65 | - | .67 |
| Rongalite CX* | lb. | —— | - | .21½ |
| Sherosopes* | lb. | .13½ | - | .18¾ |
| Sublac Resin PX-5* | lb. | .23½ | - | .24½ |
| Synpep* | lb. | .54 | - | .60 |
| Thiokol LP-2* | lb. | —— | - | .96 |
| LP-3, LP-32, LP-33* | lb. | —— | - | .96 |
| LP-8* | lb. | 1.25 | - | 1.35 |
| Tysonite* | lb. | .26 | - | .26¼ |
| VA-7* | lb. | —— | - | .50 |
| **Vanfre*** | gal. | 2.50 | - | 3.00 |

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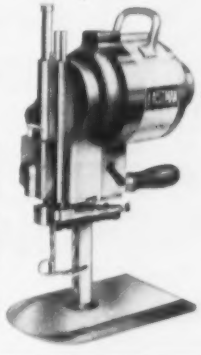

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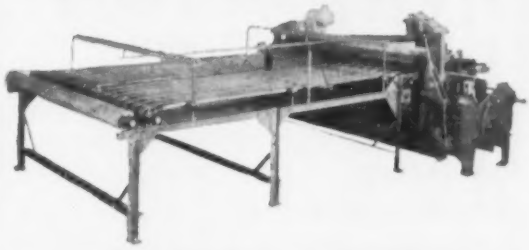

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Model T, Stokes, Hydraulic Equalizer MD

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*"Equipment for Sale" continued on next page*

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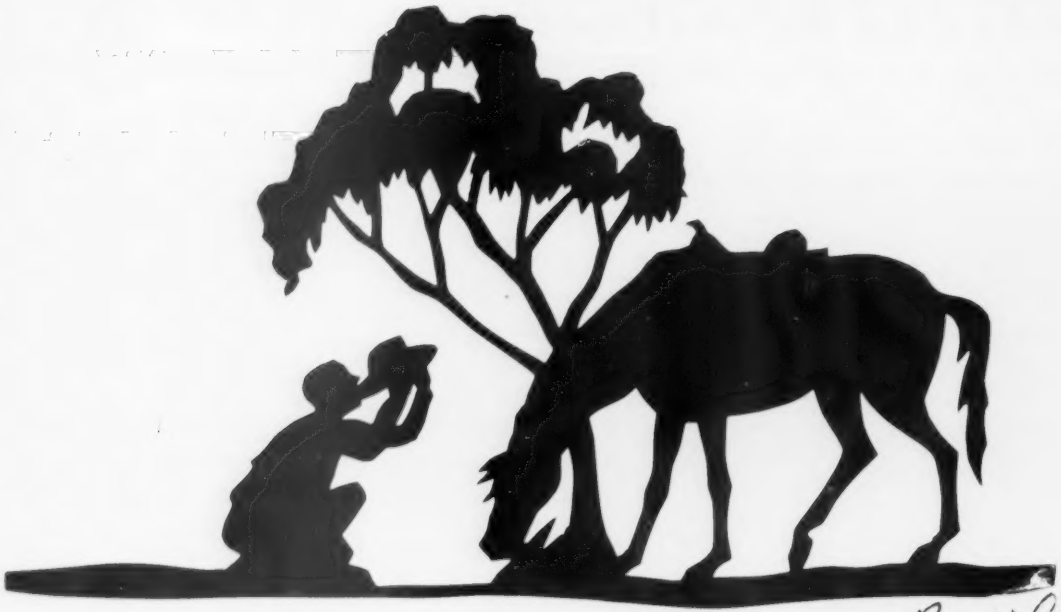


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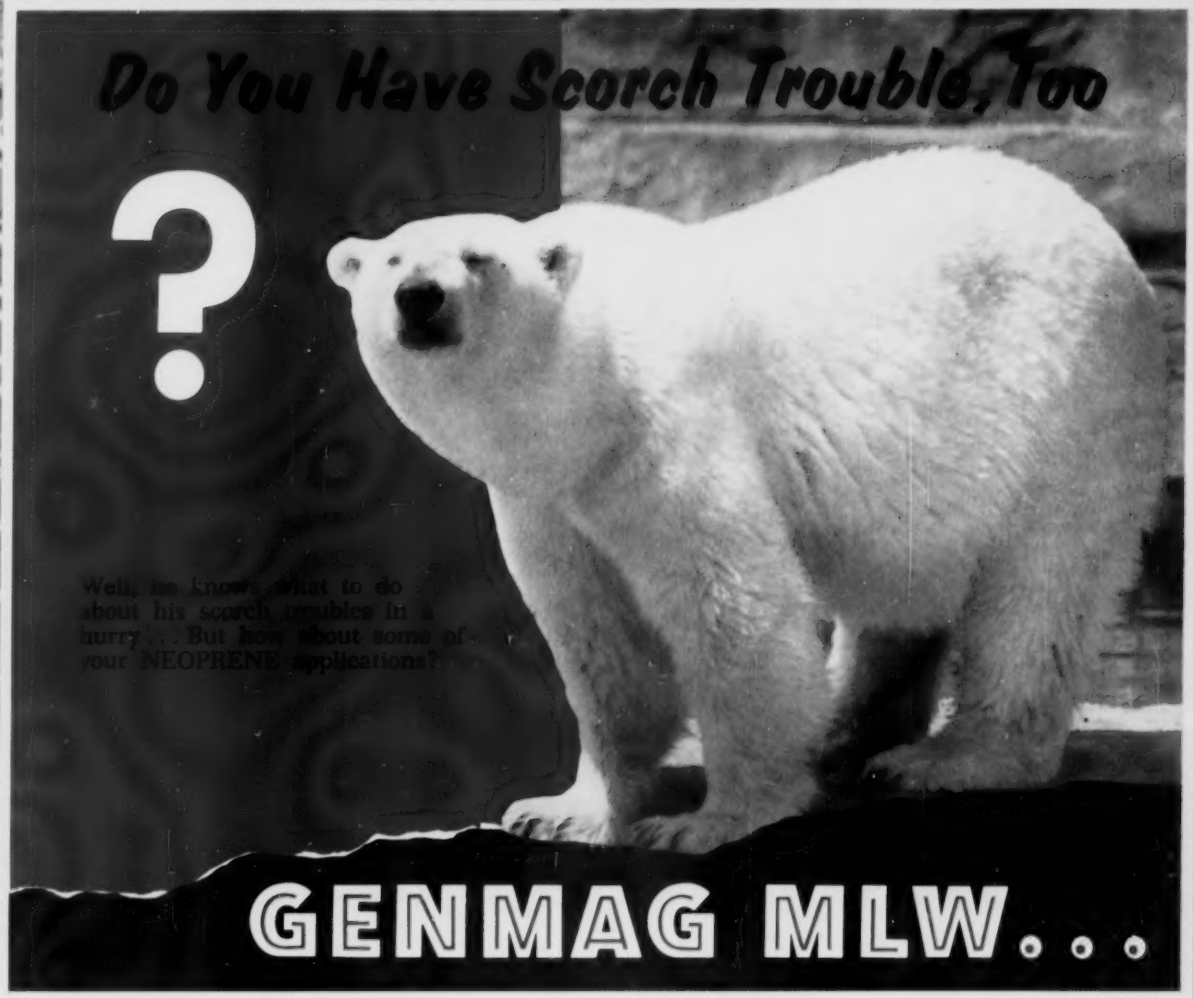
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